Catalog Number 8854

Sigma 900 MAX All Weather Refrigerated Sampler

USER MANUAL

March 2006, Edition 8

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Please read this entire manual before unpacking, setting up, or operating this instrument.

Pay particular attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

Use of Hazard Information

If multiple hazards exist, this manual will use the signal word (Danger, Caution, Note) corresponding to the greatest hazard.

DANGER
Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTE
Information that requires special emphasis.

Precautionary Labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and/or electrocution exists and indicates that only individuals qualified to work with hazardous voltages should open the enclosure or remove the barrier.
	This symbol, when noted on the product, identifies the location of a fuse or current limiting device.
	This symbol, when noted on the product, indicates that the marked item can be hot and should not be touched without care.
	This symbol, when noted on the product, indicates the presence of devices sensitive to Electro-static Discharge and indicates that care must be taken to prevent damage to them.
	This symbol, when noted on the product, identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol, if noted on the product, indicates the need for protective eye wear.
	This symbol, when noted on the product, identifies the location of the connection for Protective Earth (ground).

Hazardous Locations

The Sigma 900 MAX All Weather Refrigerated Sampler is not approved for use in hazardous locations as defined in the National Electrical Code.

DANGER
Although some Sigma products are designed and certified for installation in hazardous locations as defined by the National Electrical Code, many Sigma products are not suitable for use in hazardous locations. It is the responsibility of the individuals who are installing the products in hazardous locations to determine the acceptability of the product for the environment. Additionally, to ensure safety, the installation of instrumentation in hazardous locations must be per the manufacturer's control drawing specifications. Any modification to the instrumentation or the installation is not recommended and may result in life threatening injury and/or damage to facilities.

DANGER
Bien que certains produits Sigma soient conçus et certifiés pour être installés dans des endroits dangereux tels que définis par le National Electric Code, de nombreux produits Sigma ne conviennent pas pour de tels endroits. Il relève de la responsabilité des personnes qui placent les produits dans des endroits dangereux de déterminer s'ils sont adaptés à cet environnement. En outre, à des fins de sécurité, le placement de machines dans des endroits dangereux doit s'effectuer dans le respect des consignes des schémas de contrôle du fabricant. Toute modification apportée aux machines ou tout déplacement de celles-ci est déconseillé, car susceptible de provoquer des accidents matériels et/ou corporels.

Confined Space Entry

Important Note: *The following information is provided to guide users of Sigma samplers on the dangers and risks associated with entry into confined spaces.*

On April 15, 1993, OSHA's final ruling on CFR 1910.146, Permit Required Confined Spaces, became law. This new standard directly affects more than 250,000 industrial sites in the United States and was created to protect the health and safety of workers in confined spaces.

Definition of Confined Space

A Confined Space is any location or enclosure that presents or has the immediate potential to present one or more of the following conditions:

- An atmosphere with less than 19.5% or greater than 23.5% oxygen and/or more than 10 ppm Hydrogen Sulfide (H_2S)
- An atmosphere that may be flammable or explosive due to gases, vapors, mists, dusts, or fibers
- Toxic materials which upon contact or inhalation, could result in injury, impairment of health, or death

Confined spaces are not designed for human occupancy. They have restricted entry and contain known or potential hazards. Examples of confined spaces include manholes, stacks, pipes, vats, switch vaults, and other similar locations.

Standard safety procedures must always be followed prior to entry into confined spaces and/or locations where hazardous gases, vapors, mists, dusts, or fibers may be present. Before entering any confined space check with your employer for procedures related to confined space entry.

Specifications are subject to change without notice.

General	
Dimensions	Width 71 cm (28 in.), Depth 71 cm (28 in.), Height 125 cm (49 in.), Weight 79 kg (175 lb)
Cabinet	Fiberglass reinforced plastic with beige UV inhibited polymer laminate.
Temperature Range	-29 to +50 °C (-20 to 122 °F); With optional controller compartment heater, -40 to +50 °C (-40 to 122 °F)
Recovery Time	With door open one minute in 24 °C (75 °F) ambient and 4 °C sample temperature, 5 minutes.
Pull-Down Time	From 24 °C (75 °F) to 4 °C (39 °F), 15 minutes
Thermal System	Top mounted compressor/condenser with fan forced air cooled condenser; 3 sided wrap-around evaporator plate; 2" rigid foam insulation; microprocessor controlled thermostat maintains sample liquid at 4 °C (±1 °C); frost free; compression gasket door seal; air cooled condenser is protected against corrosion with a food grade epoxy; all exposed copper tubing is insulated to avoid sweating and condensation.
Power Requirements	115 V ac, 60 Hz (230 and 100 V ac optional); Compressor Running Amperage 1.5–2.0 A. Locked rotor current 12 amps. Installation Category II.
Optional ac Power Backup	Pump/Controller Only: Rechargeable 6 amp-hour gel lead acid battery takes over automatically with ac line power failure. Integral trickle charger maintains battery at full charge.
Internal Battery	Two C cell alkaline batteries; maintains program logic and real time clock for five years. Internal battery current draws less than 40 micro amps.
Control Panel	21 key membrane switch keypad with 4 multiple function soft keys; 8 line x 40 character alphanumeric, back-lit liquid-crystal graphics display. Self prompting/menu driven program.
Data Logging	Records program start time and date, stores up to 400 sample collection times/dates, all program entries, operational status including number of minutes or pulses to next sample, bottle number, number of samples collected, number remaining, sample identification number, and all logged data (i.e. level, flow, pH, stream temperature, refrigerated compartment sample temperature, ORP, rainfall, and any externally logged data - up to 7 external channels). Also, up to 200 events are logged, including alarm conditions, program run/stop events, etc.
Set Point Sample Trigger	When equipped with integral flow meter, pH/temperature/ORP meter, conductivity, and/or D.O. monitoring options...sampling can be triggered upon an upset condition when field selectable limits are exceeded. Concurrent with normal sampling routine, sample liquid is deposited in designated “trouble bottle(s)”.
Sampling Modes	Multiple Bottle Time, Multiple Bottle Flow, Composite Multiple Bottle Time, Composite Multiple Bottle Flow, Composite Time, Composite Flow, Flow with Time Override, Variable Interval, Start/Stop, and Level Actuation.
Program Delay	Three formats: (1) 1-9,999 minutes or flow pulses in one unit increments (2) programmable sampler start time/date, and (3) programmable time/day of week.
Overload Protection	Controller: 5 amp dc line fuse. Compressor: Thermal overload relay opens at 110 °C (230 °F)
Diagnostics	Tests keypad, display, ROM, pump, and distributor.
Program Lock	Access code protection precludes tampering.
Communications	
EPROM Flash Memory	Via RS232. Permits embedded software upgrades in the field.
Serial Interface	RS232 compatible; allows on-site collection of stored data.
Modem (optional)	14400, V.32 bis, V.42, MNP2-4 error correction. V.42 bis MNP5 data compression. MNP10-EC Cellular Protocol.
Sample Bottle Capacity	
Bottle Capacity	(24) 1-L polyethylene and/or 350 mL glass bottles. (8) 2.3-L polyethylene and/or 1.9-L glass bottles. (4) 3-gal polyethylene and/or 2½-gal glass bottles. (2) 3-gal polyethylene and/or 2½-gal glass bottles, (1) 6-gal polyethylene.

Specifications

Sampling Features	
Multiple Programs	Stores up to five separate sampling programs.
Cascade	Allows using two samplers in combination where the first sampler at the completion of the program initiates the second.
Upset Sampling	When equipped with integral flow meter, pH/temperature/ORP meter, conductivity, and/or D.O. monitoring options... Sampling can be triggered upon an upset condition when field selectable limits are exceeded, concurrent with normal sampling routine, sample liquid is deposited in designated “trouble bottle(s)”. Can also be triggered from an external trigger.
Status Output	Alerts operator to low main battery, low memory power, plugged intake, jammed distributor arm, sample collected, and purge failure.
Automatic Shutdown	Multiple Bottle Mode: After complete revolution of distributor arm (unless Continuous Mode selected). Composite Mode: After preset number of samples have been delivered to composite container, from 1–999 samples, or upon full container.
Sample Volume	Programmed in milliliters, in one mL increments from 10 to 9,999 mL.
Sample Volume Repeatability	±5% typical
Interval Between Samples	Time Proportional Sampling: Format: Selectable in single increments from 1 to 9,999 minutes in one minute increments. Flow Proportional Sampling: Continuous Volume, Variable Time (CVVT):1–9999 units of flow volume, where units are whatever is set up for in the integral flow option or-1–9999 external-meter flow pulses (momentary contact closure 25 msec or 5–12 V dc pulse; 4–20 mA interface optional) Flow Proportional Sampling: Constant Time, Variable Volume (CTVV): Format: 999: 00 hrs:min.Selectable in 1-minute increments of 1 to 59,940 minutes.
Multiplex (Multiple Bottle Mode)	Programming allows multiple samples per bottle and/or multiple bottles per sample collection.
Sample Pump and Strainer	
Sample Pump	High speed peristaltic, dual roller, with 3/8” ID by 5/8” OD medical grade silicone rubber pump tube.
Pump Body	Impact/corrosion resistant, glass reinforced Delrin®
Vertical Lift	27 ft maximum (Remote Pump Option recommended for lifts from 22 to 35 ft)
Sample Transport Velocity	2 ft/sec minimum, at 15 ft vertical lift in a 3/8” ID intake tube
Pump Flow Rate	60 mL/sec at 3 ft vertical lift in a 3/8” ID intake line
Liquid Sensor	Non-wetted, non-contact, ultrasonic
Intake Purge	Air purged automatically before and after each sample; duration automatically compensates for varying intake line lengths
Pump/Controller Housing	High impact injection molded ABS; submersible, watertight, dust tight, corrosion & ice resistant; NEMA 4X,6
Internal Clock	Indicates real time and date; 0.007% time base accuracy.
Manual Sample	Initiates a sample collection independent of program in progress.
Intake Rinse	Intake line automatically rinsed with source liquid prior to each sample, from 0 to 3 rinses.
Intake Retries	Sample collection cycle automatically repeated 0–3 times if sample is not obtained on initial attempt.
Intake Tubing	¼” and 3/8” ID vinyl or 3/8” ID Teflon* lined polyethylene with protective outer cover.
Intake Strainers	Choice of Teflon® and 316 stainless construction, and all 316 stainless steel in standard size and low profile for shallow depth applications.

Factory Installed Options

pH/Temperature/ORP Meter		
	Control/Logging	Field selectable to log pH/temperature or ORP independent of sample operation or to control sample collection in response to volume exceeding low/high setpoints.
	pH/Temperature Sensor	Temperature compensated; impact resistant ABS plastic body. Combination electrode with porous Teflon®-junction.
	Measurement Range	0 to 14 pH, -10 to 105 °C
	Operating Temperature	-18 to 80 °C (0 to 176 °F)
	Dimensions	1.9 cm dia. × 15.2 cm long (0.75 in. × 6 in.) with 1.9 cm (0.75 in.) mpt cable end.
Dissolved Oxygen Meter		
	Control/Logging	Field selectable to log dissolved oxygen independent of sampler operation or to control sample collection in response to volume exceeding low/high setpoints.
	Measurement Method	Galvanic
	Sensor	Temperature compensated; impact resistant polypropylene body.
	Measurement Range	0 to 20 mg/L
	Resolution	0.01 mg/L
	Accuracy	±3% of reading or 0.1 mg/L
	Operating Temperature	0 to 50 °C (32 to 122 °F)
	Dimensions	1.7 mm diameter × 15.7 cm long (0.65 in. × 6.25 in.) with 1.9 cm (0.75 in.)
Conductivity Meter		
	Control/Logging	Field selectable to log conductivity independent of sampler connection or to control sample collection in response to volume exceeding low/high setpoints
	Sensor	Temperature compensated; impact resistant polypropylene body.
	Measurement Range	0 to 20 mS/cm
	Resolution	0.01 mS/cm or 1 mS/cm
	Accuracy	±2% of reading or 0.01 mS
	Operating Temperature	0 to 50 °C (32 to 122 °F)
	Dimensions	1.7 cm diameter × 15.2 cm long (0.67 in. x 6 in.) with 1.9 cm (0.75 in.) mpt cable end
Rain Gauge Input		
	General Information	For use with Tipping Bucket Rain Gauge. The Sampler Program can be initiated upon field selectable rate of rain. Sampler records rainfall data. Each tip = 0.25 mm (0.01in.) of rain.
Analog Input Channels		
	General Information	Up to 3 additional data logging channels record data from external source(s) Field assignable units. -4.0 to +4.0 V dc and 0 to 20 mA
4–20 mA Output		
	General Information	Up to 2 output signals available. User assignable.
	Max. Resistive Load	600 ohms
	Output Voltage	24 V dc—no load
	Insulation Voltage	Between flow meter and 4–20 mA output—2500 V ac. Between the two 4–20 mA outputs—1500 V ac.

Specifications

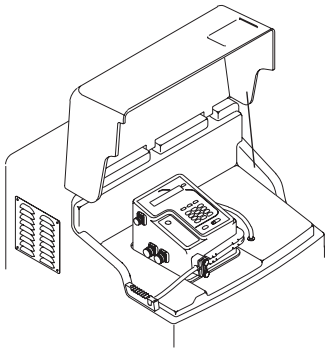
Alarm Relays		
	General Information	(4) 10 amp/120 V ac or 5 amp/220 V ac form C relays. ±0.1% FS Error User assignable for any internal or external data channel or event.
Downlook Ultrasonic Sensor 40 kHz		
	Accuracy	0.003 m (±0.01 ft)
	Maximum Range	3.35 m (11 ft) with a 3.05 m (10 ft) span
	Deadband	38 cm (15 in.) maximum, self-minimizing
	Material	PVC housing with Buna-N acoustic window.
	Cable	4 conductor with integral stainless steel support cable
Submerged Pressure Transducer		
	Material	Epoxy body with stainless steel diaphragm.
	Cable	Polyurethane sensor cable with air vent.
	Cable Length	7.6 m (25 ft) standard; 76 m (250 ft) maximum
	Sensor Dimensions	2 cm H x 3.8 cm W x 12.7 cm L (0.8 in. x 1.5 in. x 5 in.)
	Maximum Range	5 psi, 0.063 to 3.5 mm (0.018 to 11.5 ft); 15 psi, 0.063 m to 10.5 m (0.018 to 34.6 ft)
	Maximum Allowable Level	3x over pressure
	Operating Temp. Range	0 to 71 °C (32 to 160 °F)
	Compensated Temp. Range	0 to 30 °C (32 to 86 °F)
	Air Intake	Atmospheric pressure reference is desiccant protected.
Submerged Area/Velocity Probe		
	Method	Doppler Principle/Pressure Transducer.
	Material	Polymer body, 316 series stainless steel diaphragm.
	Cable	8-conductor urethane sensor cable with air vent.
	Cable Length	7.6 m (25 ft) standard
	Sensor Dimension	Length: 12.7 cm (5 in.) Width: 3.8 cm (1.5 in.) Height: 2 cm (0.8 in.)
	Velocity	Velocity accuracy: 2% of reading; Zero Stability: <0.015 m/s (<0.05 fps). Response time: 4.8 seconds. Profile Time: 4.8 seconds. Range: -1.52 to 6.1 mps (-5 to +20 fps). Resolution: 0.3 cm (0.01 fps).
	Depth	Depth Accuracy: 0–3.35 m (0–11 ft) 1.37 mm (±0.054 in.); 0–10.06 m (0–33 ft) 4.09 mm (±0.161 in.)
		Maximum Allowable Level: 3x over pressure.
		Operating Temperature Range: 0 to 71 °C (32 to 160 °F).
		Compensated Temperature Range: 0 to 30 °C (32 to 86 °F).
		Temperature Error: 0.005 to 3.5 m ±0.0022 m/°C (0.018 to 11.5 ft ±0.004 ft/°F) 0.005 to 10.5 m ±0.006 m/°C (0.018 to 34.6 ft ±0.012 ft/°F) (maximum error w/in compensated temperature range—per degree of change)
		Velocity Induced Error on Depth (patent pending): 0–3.05 mps (0–10 fps)=0.085% of reading.
		Air Intake: Atmospheric pressure reference is desiccant protected.

The sampler is housed in a resin transfer-molded fiberglass cabinet which is designed for indoor or outdoor locations. No secondary enclosure is required. The refrigeration compressor is located on top of the sampler to avoid hydrogen sulfide and other corrosive, heavier than air gases. The microprocessor in the sampler controller runs all refrigeration and heating operations directly without relying on mechanical thermostats. No mechanical thermostat adjustments are required. All temperature settings, setup, and calibrations are performed via the front panel.

1.1 Controller Cover

The lockable top cover protects the controller compartment from extreme weather as well as unauthorized use. When open, it is supported with a simple rod and clip similar to a car hood support (see Figure 1). Padlocks are available from the manufacturer (Cat. No. 954).

Figure 1 Controller Cover



1.2 Controller Compartment Heater

The optional 500 watt controller compartment heater provides several benefits in colder climates:

- Prevents residual liquid from freezing in the pump.
- Pump tubing stays resilient, prolonging the life of the tubing, pump rollers, motor, and gear box.
- Prevents ice and snow from building up on the cover.
- Keeps LCD functional and electronics from temperature extremes.

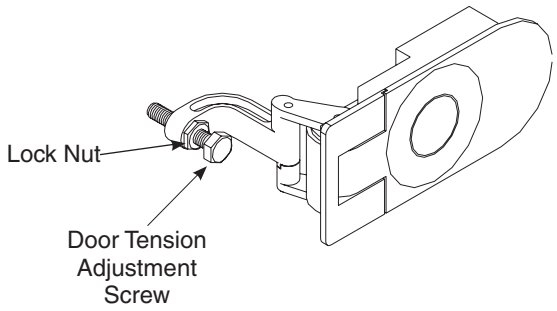
The compartment heater operation is microprocessor controlled and automatic.

1.3 Refrigeration Compartment Door

The lockable front door opens by pressing the round button in the center of the latch. When closing the door, flip the latch closed to pull the door tight. Two keys are provided for the door lock.

Since the door gasket may compress slightly over time, an adjustment screw is provided to allow the door to be tightened. Loosen the lock nut before making adjustments and retighten the lock nut when done (Figure 2).

Figure 2 Door Latch



1.4 Interface Connectors

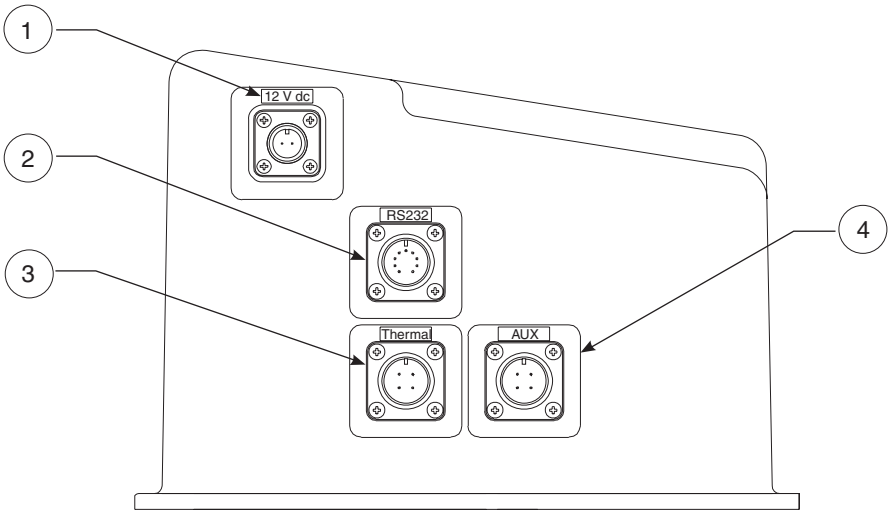
Interface connectors are located on the left side of the controller housing. An optional weather tight terminal box located on the back of the sampler provides conduit termination for all input/output lines.

The sampler comes standard with two interface receptacles.

- 12 V dc (Power Input)
- Auxiliary (Multi-purpose input/output port)
- RS232 (Serial communications port)
- Thermal (Control port for heating and cooling system)

In addition, the sampler can be used with a wide variety of optional devices including level and flow sensors, rain gauge, pH/ORP, D.O., temperature, conductivity, Modem, 4–20 mA current loop, and three additional analog inputs of 4–20 mA or -4.0 V dc to +4.0 V dc.

Figure 3 Controller Housing Connectors



1. 12 V dc	**2.** RS232	**3.** Thermal	**4.** Auxiliary

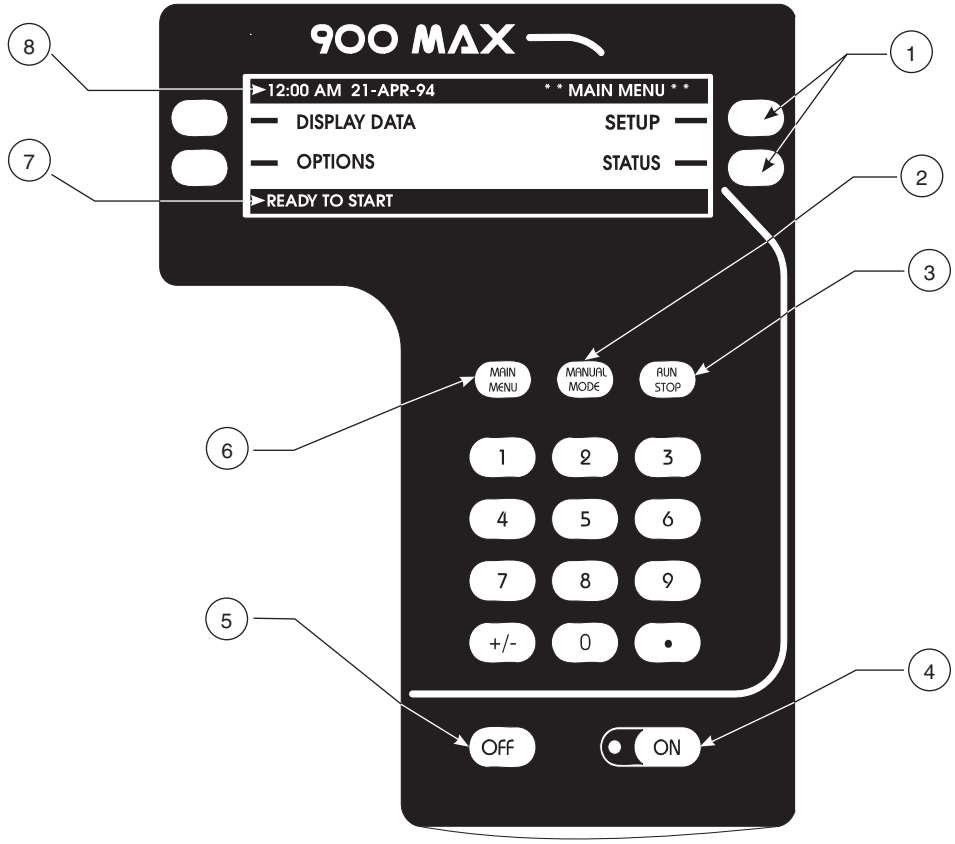
1.4.1 Receptacle Caps

Interface receptacles are covered with push-on receptacle caps. These caps protect the connector pins from dirt and moisture and should be attached to any receptacle not in use.

1.5 Front Panel

The front panel of the sampler consists of the keypad, liquid crystal display, and the internal case humidity indicator.

Figure 4 Front Panel



1. Soft Keys	**5.** Power OFF Key
2. Manual Mode Key	**6.** Main Menu Key
3. Run/Stop Key	**7.** Status Bar
4. Power ON Key	**8.** Menu Bar

1.5.1 Keypad Description

The keypad includes the numeric keypad, soft keys, and function keys.

Numeric Keypad
The numeric keypad consists digits 0 through 9, a +/- key, and a decimal key.

“Soft” Keys
Soft keys are blank, white keys located to the left and right of the display. The appearance of each function key depends on the display. The key is not active when there is no function displayed. The soft keys appear on the display and point to the proper soft key to push for that action.

In some cases during a programming step an item from a list needs to be selected. The soft keys on the right side of the display will change to display “up” and “down” arrows. Scroll up and down the list of choices.

Power ON/OFF Key
Press **ON** to turn the instrument on, a green light will flash to indicate power is active. To turn the instrument off, press **OFF**.

Function Keys
There are three function keys that are used while operating the sampler (see Table 1). These functions are dedicated keys to allow quick access. They are the white keys located just above the numeric keypad.

Table 1 Function Key Descriptions

Main Menu	
	This is the starting point to get to any other point in the program. Press the Main Menu key at any time during programming to return to the Main Menu Screen. The current action is cancelled if changes are not yet accepted.
Manual Mode	
	Manually controls the operation of the sample pump and the distributor arm.
	ADVANCED DISTRIBUTOR soft key: Moves the distributor arm to the user selected bottle. Used to verify the operation of the distributor or when repositioning the arm if it was moved by hand.
	GRAB SAMPLE soft key: Takes a sample in the same manner as when a program is running. Includes all pre-rinses and sample retries, if programmed.
	PUMP OPERATION soft key: Allows manual control of the pump in both forward and reverse directions. Once started, the pump is stopped by pressing any key.
Run/Stop	
	Runs (or resumes) a program and stops a currently running program.

1.5.2 Liquid Crystal Display

Table 2 LCD Displays

Menu Bar	The Menu Bar appears in a black band on the top edge of the display. The upper left corner of the menu bar shows the time and date. The upper right corner shows the name of the current menu (Figure 4).
Status Bar	The Status Bar appears along the bottom edge of the display. The appearance of the status bar changes depending upon the function performed (Figure 4). The lower left corner of the Status Bar indicates whether a program is Complete, Running, Halted, or Ready To Start. If it is not needed during a programming step, it disappears. The lower right corner displays system alarm conditions, such as low memory battery, jammed distributor etc. For a list of possible alarms refer to section 6.4 on page 87. The status bar also lists the valid choices when entering certain programming information.

1.5.3 Internal Humidity Indicator

The internal case humidity indicator (Cat. No. 2660) turns pink when the internal case humidity exceeds 60 percent.

The sampler is equipped with an internal desiccant module (Cat. No. 8849) to absorb any humidity trapped in the case during final assembly. Under normal operating conditions, this desiccant provides long-term protection against condensed moisture inside the case.

Replacement of the internal desiccant module is only necessary if the indicator turns pink. See to section 7.10 on page 101 for details.

INSTALLATION

DANGER

Some of the following manual sections contain information in the form of warnings, cautions and notes that require special attention. Read and follow these instructions carefully to avoid personal injury and damage to the instrument. Only personnel qualified to do so, should conduct the installation/maintenance tasks described in this portion of the manual.

DANGER

Certains des chapitres suivants de ce mode d'emploi contiennent des informations sous la forme d'avertissements, messages de prudence et notes qui demandent une attention particulière. Lire et suivre ces instructions attentivement pour éviter les risques de blessures des personnes et de détérioration de l'appareil. Les tâches d'installation et d'entretien décrites dans cette partie du mode d'emploi doivent être seulement effectuées par le personnel qualifié pour le faire.

PELIGRO

Algunos de los capítulos del manual que presentamos contienen información muy importante en forma de alertas, notas y precauciones a tomar. Lea y siga cuidadosamente estas instrucciones a fin de evitar accidentes personales y daños al instrumento. Las tareas de instalación y mantenimiento descritas en la presente sección deberán ser efectuadas únicamente por personas debidamente cualificadas.

GEFAHR

Einige der folgenden Abschnitte dieses Handbuchs enthalten Informationen in Form von Warnungen, Vorsichtsmaßnahmen oder Anmerkungen, die besonders beachtet werden müssen. Lesen und befolgen Sie diese Instruktionen aufmerksam, um Verletzungen von Personen oder Schäden am Gerät zu vermeiden. In diesem Abschnitt beschriebene Installations- und Wartungsaufgaben dürfen nur von qualifiziertem Personal durchgeführt werden.

PERICOLO

Alcune parti di questo manuale contengono informazioni sotto forma d'avvertimenti, di precauzioni e di osservazioni le quali richiedono una particolare attenzione. La preghiamo di leggere attentivamente e di rispettare quelle istruzioni per evitare ogni ferita corporale e danneggiamento della macchina. Solo gli operatori qualificati per l'uso di questa macchina sono autorizzati ad effettuare le operazioni di manutenzione descritte in questa parte del manuale.

DANGER
This instrument should be installed by qualified technical personnel to ensure adherence to all applicable electrical codes.

2.1 Unpacking the Instrument

Remove the sampler from the shipping carton and inspect it for any damage. Contact Hach Customer Service at 1-800-227-4224 if any items are missing or damaged.

2.2 Selecting the Installation Site

DANGER
This product is not designed for hazardous locations where combustible environments may exist.

Follow the simple guidelines below to allow complete drainage of the intake line and prevent cross-contamination between samples.

- Install the sampler as close to the sample source as site conditions permit to increase pump tube life and optimize sampler performance.
- Install the sampler above the sample source, with the intake tubing sloping downward to the sample.
- Make sure that the intake tubing is free of kinks or loops.

2.3 Installing the Sampler

The sampler can be installed using the optional anchor bracket mounting kit (Cat. No. 8935).

1. Determine the proper site location for individual permanent installation.
2. Level the sampler using four leveling feet. Raise the sampler by turning the feet clockwise.
3. Locate the screws around the base of cabinet. The front and rear screws are used to mount the anchor brackets to the sampler.
4. Remove one screw from the cabinet. Slide the screw through the slot in the anchor bracket and tighten halfway.

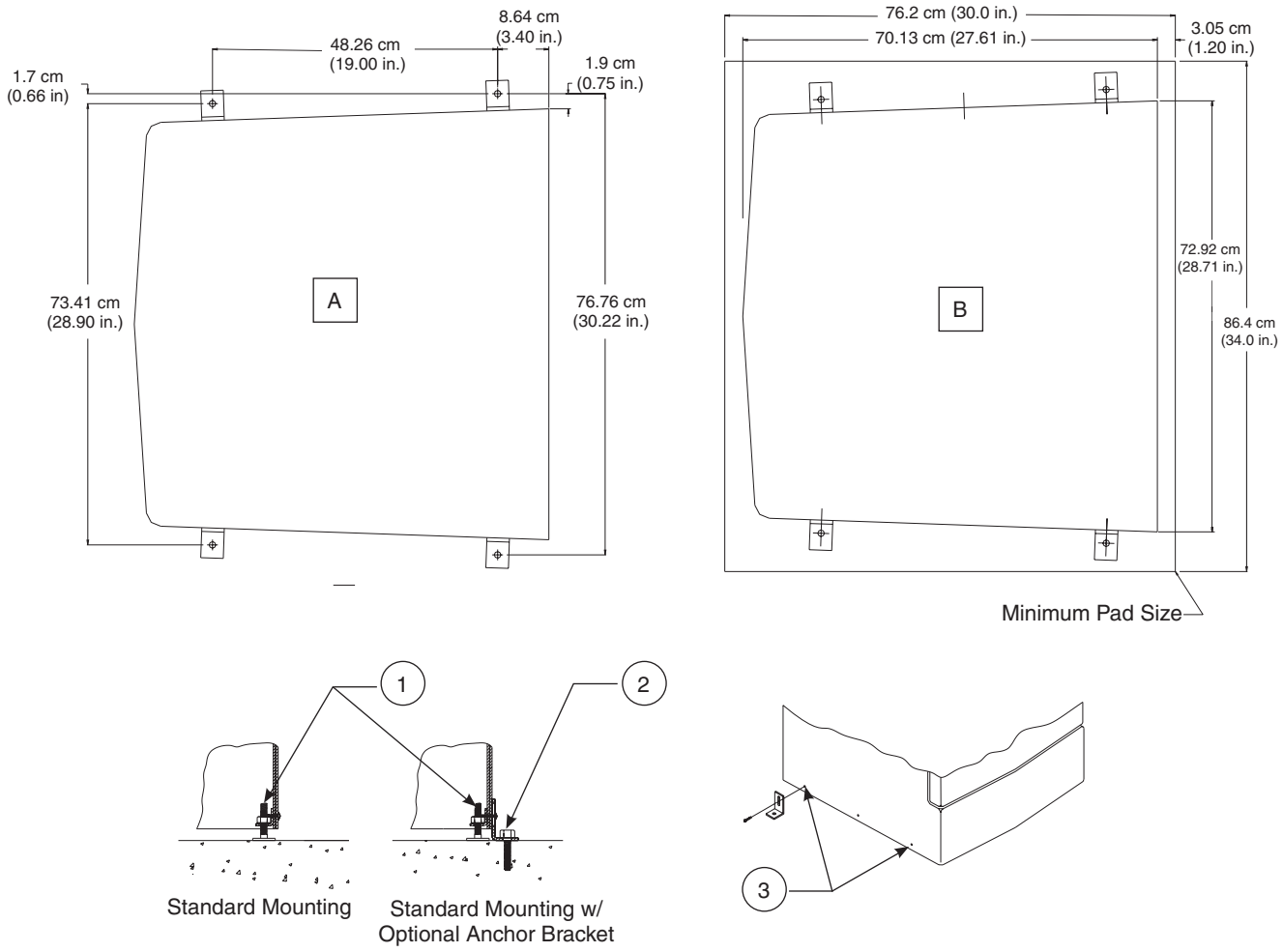
Note: *Install only one bracket at a time. The sampler may become unstable if multiple screws are removed at once.*

5. With screw still loose, allow the anchor to drop down firmly in contact with mounting surface (floor, concrete, etc.)
6. Assemble the remaining three brackets.

Note: *A customer-supplied 7/16 bolt or stud is recommended to ensure secure mounting.*

7. Complete installation by securing the anchor brackets to the mounting surface as required for individual installation.

Figure 5 Anchor Bracket Mounting Kit



A. AWRS Footprint with Optional Anchor Frame		**B.** AWRS Permanent Installation Mounting Pad
1. Level Foot Mounting	**2.** 7/16 Bolt or Stud Recommended (not supplied)	**3.** 2 Places Each Side

2.4 Installing the Pump Tube in the Sensor Body

Note: *Do not stretch the tubing in the sensor body, as this could affect the ability of the sensor to detect liquid through the pump tubing.*

Note: *You must use the proper length of silicone tubing in the pump body. An improper length can reduce the life of the tubing and pump rollers. Refer to Figure 6 for the correct length.*

1. Remove the four screws on the pump cover.
2. Remove the front cover of the pump housing. Remove the tubing. Locate the black dots on the tubing. The end of the tube that extends farthest beyond the black dot attaches to the stainless steel tubing connector.
3. Install the pump tube in the pump housing so the black dots are visible just outside the pump body.
4. After inserting the new pump tube as shown, reinstall the front cover and secure it with the four screws until finger tight.
5. Make sure that the tubing extends through the liquid sensor and out of the controller as shown in Figure 7.

Figure 6 Pump Tube Loading

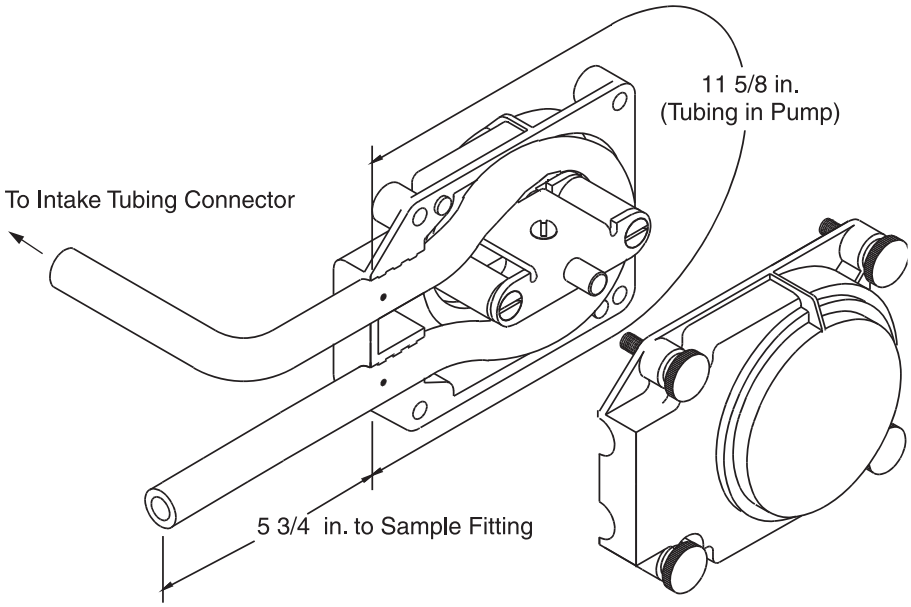
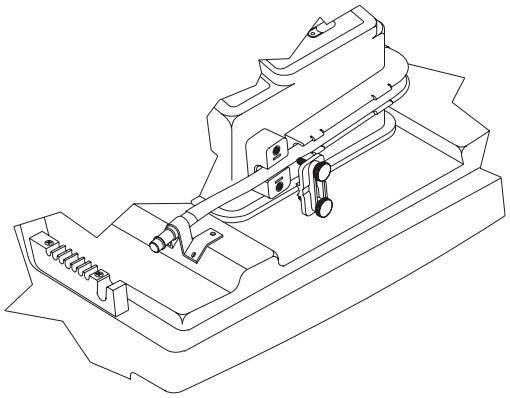


Figure 7 Installing Pump Tube Through the Sensor Body



2.4.1 Attaching the Intake Line

Attaching the Vinyl Tubing

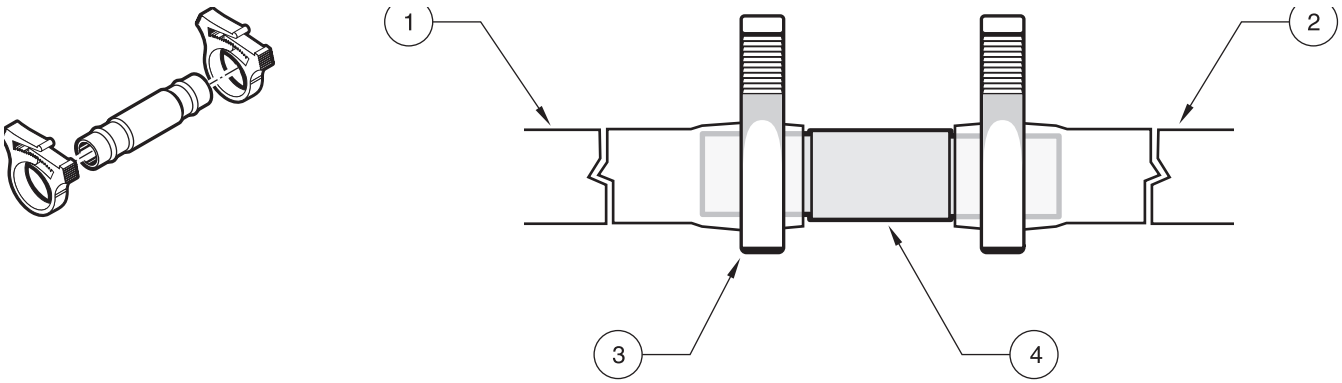
The connection kit (Cat. No. 2248) contains two identical assemblies, one for connecting vinyl tubing to the tubing attached to the sampler, and the other for connecting the vinyl tubing to an intake strainer or remote pump. The kit contains four hose clamps and two stainless steel tubing connectors.

1. Push one end of the tubing connector into the vinyl tubing attached to the controller until the tubing abuts the shoulder of the tubing connector. Secure with a tubing clamp (Figure 8).

2. Push the other end of the tubing connector into the vinyl tubing until the tubing abuts the shoulder of the tubing connector and secure with a tubing clamp (Figure 8).

3. Repeat Step 1 and Step 2 for the fitting that connects the vinyl tubing to an intake strainer or a remote pump.

Figure 8 3/8” Vinyl Tubing Connector



1. Vinyl tubing to controller	**3.** Tubing clamp (2 required)
2. Vinyl tubing to strainer or pump.	**4.** Stainless steel tubing connector

Attaching the Teflon®-Lined Tubing

The Connection Kit for Teflon-lined Tubing (Cat. No. 2186) contains two identical assemblies, one for connecting the Teflon-lined tubing to the stainless steel tubing connector and the other for connecting the Teflon-lined tubing to the intake strainer. The kit contains six clamps, two lengths of silicone tubing, and two stainless steel barbed fittings.

To connect the Teflon-lined tubing follow the instructions and Figure 9 below:

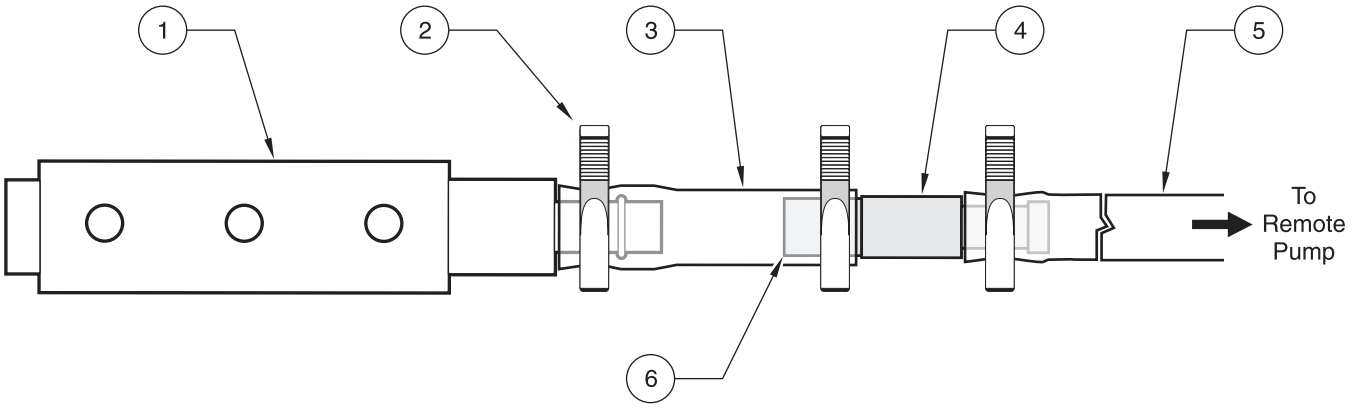
1. Place the Teflon-lined tubing over the tubing connector nipple until it abuts the shoulder of the tubing connector and secure with a tubing clamp.

2. Place one end of the silicone tubing over the wide end of the tubing connector and secure with a tubing clamp.

3. Slide a second tubing clamp over the other end of the silicone tubing. Push the silicone tubing over the stainless steel fitting on the intake strainer and tighten the tubing clamp.

4. Repeat the procedure for the fitting that connects the Teflon-lined tubing to the silicone pump tubing.

Figure 9 3/8″ ID Teflon-lined Tubing Attached to Intake Strainer and Tubing Connector



1.	Intake strainer	**4.**	Stainless steel tubing connector
2.	Tubing clamp (3 required)	**5.**	Teflon-lined intake tubing
3.	Two-inch piece of silicone tubing	**6.**	Wide end of stainless steel tubing connector

2.4.2 Setting Up the Intake Line and Strainer

Note: *If site conditions do not permit the intake to slope downward from the sampler to the sample source, disable the liquid sensors and calibrate the sample volume using the Timed Calibrate method when programming the sampler.*

For each sampling location, the intake line should be as short as practical, and be free of any sharp bends, coils, or loops. Install the intake line with a downward slope from the sampler to the sample source because:

- This will ensure the complete drainage of the intake line when it is air-purged before and after each sample, and will help to prevent cross-contamination of the individual samples.
- Complete drainage is important in freezing conditions, as any liquid slugs that remain could freeze and plug the line.

Place the sample intake and strainer in the mainstream of the sampling source, in an area of turbulent and well mixed flow.

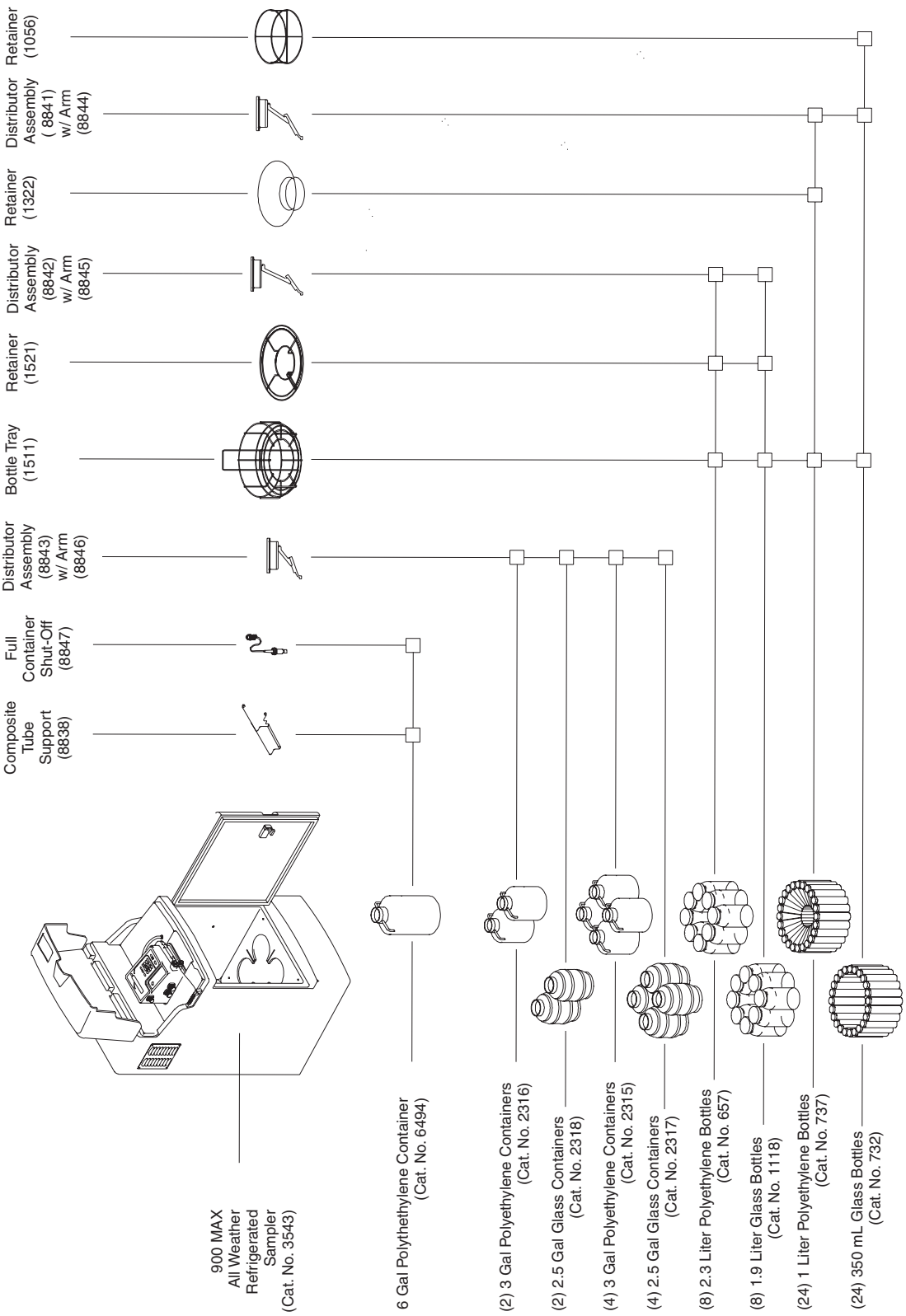
Note: *Vertical lift should not exceed 27 ft. If your site requires more lift, you may purchase the Remote Pump Option. See* *Parts and Accessories on page 147**.*

Also, you must account for the vertical location of the intake. A position too near the surface may yield excess lighter materials, while a position too near the bottom may yield excess heavy materials. The constituents of interest must be considered when positioning the intake strainer.

2.5 Choosing Bottle and Retainer Configurations

A broad range of bottle configurations is available for the Sigma 900 MAX All Weather Refrigerated Sampler.

Figure 10 Bottle Configurations


Retainer (1056)
Distributor Assembly (8841) w/ Arm (8844)
Retainer (1322)
Distributor Assembly (8842) w/ Arm (8845)
Retainer (1521)
Bottle Tray (1511)
Distributor Assembly (8843) w/ Arm (8846)
Full Container Shut-Off (8847)
Composite Tube Support (8838)
900 MAX All Weather Refrigerated Sampler (Cat. No. 3543)
6 Gal Polythethylene Container (Cat. No. 6494)
(2) 3 Gal Polyethylene Containers (Cat. No. 2316)
(2) 2.5 Gal Glass Containers (Cat. No. 2318)
(4) 3 Gal Polyethylene Containers (Cat. No. 2315)
(4) 2.5 Gal Glass Containers (Cat. No. 2317)
(8) 2.3 Liter Polyethylene Bottles (Cat. No. 657)
(8) 1.9 Liter Glass Bottles (Cat. No. 1118)
(24) 1 Liter Polyethylene Bottles (Cat. No. 737)
(24) 350 mL Glass Bottles (Cat. No. 732)

2.6 Setting Up the Bottles

2.6.1 One-Bottle Sampling

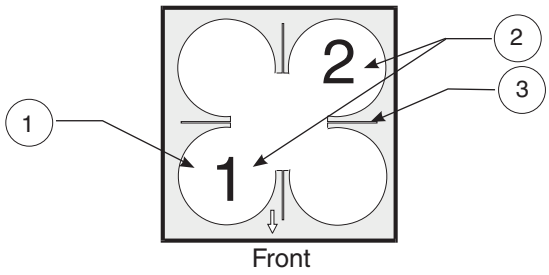
For single bottle composite sampling, install the Full Bottle Shut-off (refer to Section 2.8 on page 28) and place the bottle in the center of the bottle tray (Figure 16 on page 28). The Full Bottle Shut-off positions the sample tubing over the bottle mouth.

2.6.2 Two- and Four-bottle Sampling

For two-bottle sampling, install the distributor (refer to Section 2.7 on page 26) and place the bottles in the Bottle #1 and Bottle #2 positions in the tray as shown in Figure 11.

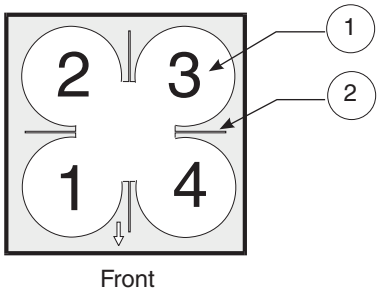
For four-bottle sampling, install the distributor and place all four bottles in the tray as shown in Figure 12.

Figure 11 Two-bottle Locations



1. Single Bottle Location	**2.** Two Bottle Location	**3.** Slots for Wire From Bottle Tray (8 or 24 bottle)

Figure 12 Four-bottle Locations



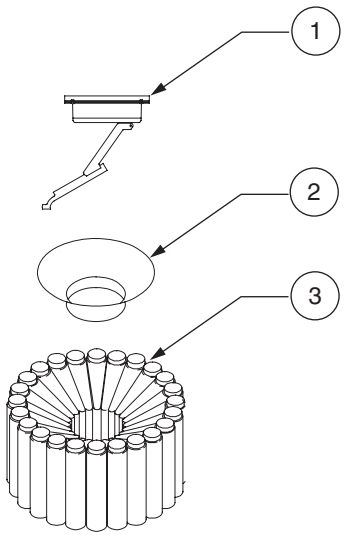
1. 1, 2, or 4 Bottle Locations	**2.** Slot for Wire From Bottle Tray (8 or 24 bottles)

2.6.3 Eight-, 12-, or 24-bottle Sampling

For eight-, 12- or 24-bottle sets, install the distributor (refer to section 2.7 on page 26). Place the bottles in the tray and install the proper bottle retainer (Figure 13).

Bottle #1 is the first bottle clockwise (looking down on the tray) from the right side of the tray. Bottle #1 is located on the inside of each bottle tray for all multiple bottle sets (Figure 13).

Figure 13 Eight-, 12-, or 24-bottle Configuration



1. Distributor	**2.** Retainer	**3.** Bottles and Bottle Tray

2.7 Installing the Distributor

Note: *Make sure the sampler is powered off before removing or installing the distributor.*

For multiple bottle sampling, a motorized arm (Distributor) is provided to automatically position the sample tube over the proper bottle. The microprocessor-controlled distributor arm can automatically locate two, four, eight, 12, or 24 discrete bottles.

To install the distributor:

1. Locate the two slots along one edge of the distributor assembly base plate (Figure 15). Slide the distributor assembly, slots first, under the shoulder screws located on the top inside surface of the controller section.

2. When fully seated, hand tighten the knurled thumbscrew to hold the distributor in place.

3. To ensure the arm has sufficient freedom of movement, hand-rotate the arm to the opposite end of the Arm Stop.

4. Install the silicone distributor tubing to the sample fitting on the top underside surface of the controller housing.

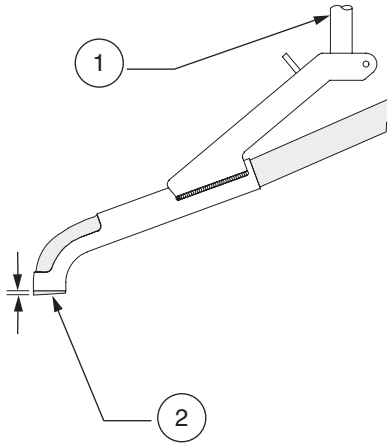
Note: *Do not force the arm past the Arm Stop clip. The Arm Stop keeps the arm from being rotated more than 360 degrees. This keeps the distributor tubing from kinking.*

The distributor tubing should be installed so that the end of the tubing extends out of the nozzle end of the distributor arm no more than 1/8 in. (Figure 14). Do not let the tubing extend more than 1/8 in. past the nozzle end of the arm.

2.7.1 Distributor Arm Alignment

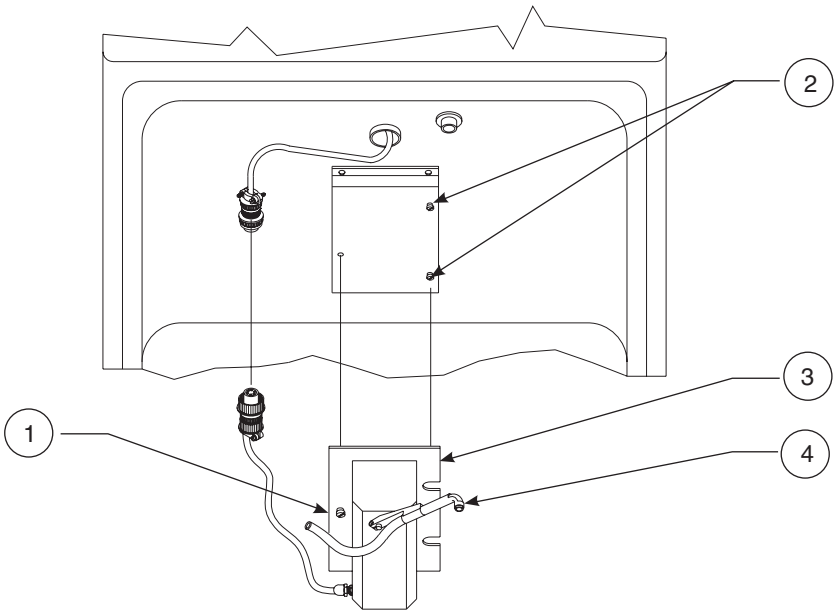
1. Program the sampler for 24-bottle operation.
2. Press **START PROGRAM** to set the distributor shaft to the Bottle #1 position.
3. Place the arm on the distributor shaft and align the rib on the inside wall of the control housing skirt.
4. Secure the arm to the shaft by tightening the 1/8 in. hex-head screw, located on the distributor arm.

Figure 14 Distributor Tubing in Arm



1. Distributor Shaft	**2.** Nozzle End (1/8 in. max)

Figure 15 Distributor Installation

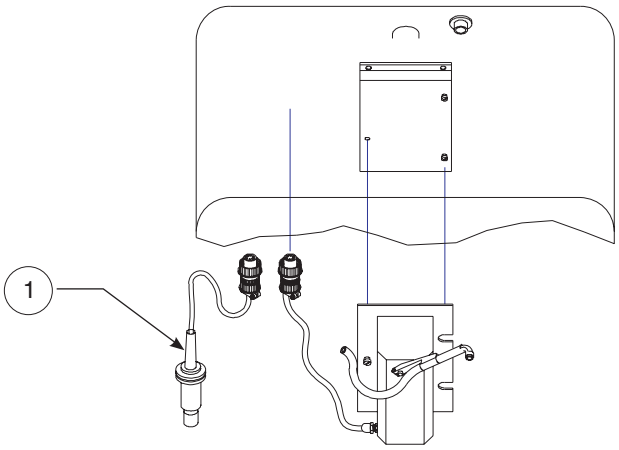


1. Thumbscrew	**2.** Shoulder Screws	**3.** Distributor Assembly	**4.** Distributor Arm

2.8 Installing the Full-Bottle Shut-Off Device

1. Install the rubber grommet into the hole provided in the cap of the composite bottle.
2. Slide the Full Bottle Shut-Off, float first, into the bottle through the center of the grommet.
3. Insert the Full Bottle Shut-Off connector into the receptacle (Figure 16).

Figure 16 Full Bottle Shut-off Installation



1.	Full Container Shut-off (Cat. No. 8847)

2.9 Power Connections

Note: *Install the sampler on its own circuit to ensure a continuous, stable source of power.*

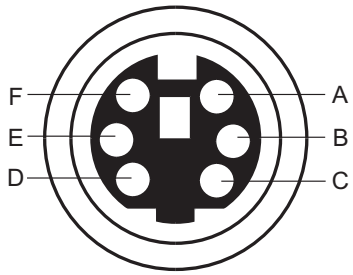
The sampler refrigerator operates on 120 V ac (100 and 230 V ac optional), and has an internal circuit breaker in the Power Junction Assembly Control Box located in the upper rear compartment (see section 7.12 on page 102). The controller requires 12 V dc which is supplied via an internal ac/dc power converter. The unit may be ordered with a 3-prong ac power cord or a conduit connection suitable for a junction box and hard-wire permanent installation.

Important: Whenever electricity is present, there is a possibility of electrical shock. Before connecting the sampler to an ac power source, take the following safety precautions:

1. Check the power source to make sure that it satisfies the ac power requirements of the sampler.
2. Make sure that all electrical installations and connections are in accordance with national and local electrical codes.
3. Disconnect the sampler from the power source.
4. Do not attempt to make any connection or otherwise handle the electrical components of the sampler when connected to ac line power if the immediate area is wet, or if hands or clothing are wet.
5. If the circuit breaker or fuse in the ac power source is tripped, determine the cause before restoring power to the sampler.

6. Make sure the power circuit is grounded and protected with a Ground Fault Interrupter (GFI).

2.10 Auxiliary Receptacle Pin Identification

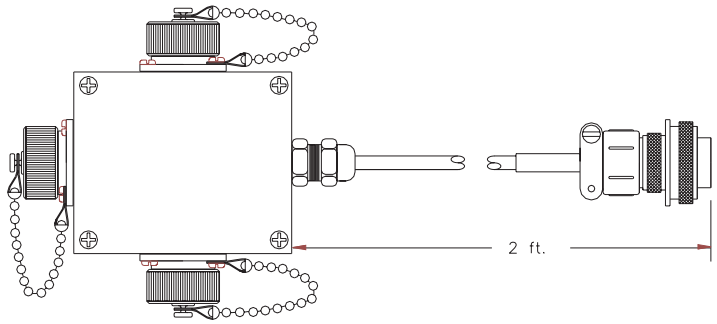


Pin A/White (12 V dc)	Powers an external device or flow meter. Must be used in conjunction with Pin B (ground).
Pin B/Blue (Ground)	Connected to dc ground and is isolated from the earth ground found in the ac power line.
Pin C/Yellow (Pulse Input)	With the sampler in Flow Proportional mode and connected to an external flow meter, a 5 to 12 V dc input pulse lasting at least 25 milliseconds will cause the sampler to decrement one count. The 12 V dc line found on Pin A can be used directly with a simple contact closure to Pin C or an external 5 to 12 V dc pulse may be applied providing the ground side of the external signal is connected to the sampler ground at Pin B. This count is actuated at the beginning of the input signal (the leading edge of the pulse).
Pin D/Black (Liquid Level Actuator/ Auxiliary Control Input)	This line is held at 5 V dc inside the sampler. When shorted to ground (Pin B), a signal is sent to the microprocessor inside the sampler causing it to “wake up” and begin or resume its sampling program. It can be used in conjunction with a simple level float to actuate the sampler when liquid is present or to take over after a second sampler has finished its program. It may also be used with any device (such as a pH meter) that produces a dry contact output to control the sampler in response to some user-defined condition (i.e. high or low pH); must be used in conjunction with Pin B.
Pin E/Red (Special Output)	Normally at 0 V dc, this line goes to 12 V dc upon any of the selected events.
Pin F/Green (Program Complete Output)	Normally an open circuit, this line switches to ground for 90 seconds at the conclusion of the sampling program. Used to “wake up” another sampler to take over sampling or to signal an operator or data logger upon the completion of the sampling program. This pin is also used to signal the bottle full condition in a single bottle/continuous mode, and will transmit the bottle # to a 950 Flow Meter if the program complete signal is disabled.

2.10.1 Splitter Interface

Use the Splitter Interface (Cat. No. 939) when more than one of the signals listed above are needed simultaneously. Connecting the interface to the 6-pin connector on the sampler provides three additional connectors. Two or more interfaces may be connected in series to allow for additional connections.

Figure 17 Splitter Interface



2.11 Thermal Control

The thermal control port is used to connect the sampler controller to the Power Supply/Thermal Control Box located inside the sampler back cover of the unit. This port carries all temperature measurement, refrigeration, and heating control signals.

Table 3Thermal Control Pin Assignments

Pin	Signal Description	Wire Color
A	TS-1	Orange
B	TS-2	Brown
C	TS-3	Yellow
D	Heat	Black
E	V AD+	Red
F	AD Ref	Green
G	Evaporator Heater	Purple
H	Compressor Fan	Gray
J	A Ground	Blue
K	Ground	White

OPERATION

DANGER

Handling chemical samples, standards, and reagents can be dangerous. Review the necessary Material Safety Data Sheets and become familiar with all safety procedures before handling any chemicals.

DANGER

La manipulation des échantillons chimiques, étalons et réactifs peut être dangereuse. Lire les Fiches de Données de Sécurité des Produits (FDSP) et se familiariser avec toutes les procédures de sécurité avant de manipuler tous les produits chimiques.

PELIGRO

La manipulación de muestras químicas, estándares y reactivos puede ser peligrosa. Revise las fichas de seguridad de materiales y familiarícese con los procedimientos de seguridad antes de manipular productos químicos.

GEFAHR

Das Arbeiten mit chemischen Proben, Standards und Reagenzien ist mit Gefahren verbunden. Es wird dem Benutzer dieser Produkte empfohlen, sich vor der Arbeit mit sicheren Verfahrensweisen und dem richtigen Gebrauch der Chemikalien vertraut zu machen und alle entsprechenden Materialsicherheitsdatenblätter aufmerksam zu lesen.

PERICOLO

La manipolazione di campioni, standard e reattivi chimici può essere pericolosa. La preghiamo di prendere conoscenza delle Schede Techniche necessarie legate alla Sicurezza dei Materiali e di abituarsi con tutte le procedure di sicurezza prima di manipolare ogni prodotto chimico.

Section 3 Basic Programming Setup

3.1 Initial Power-Up of Sampler

After pressing the **ON** key, the sampler performs a complete diagnostic test and displays the menu shown when the unit was last turned off. Set the instrument programming features when the Main Menu is displayed. The Main Menu is the starting point for all programming operations. The Main Menu offers four choices:

- Setup—Basic and Advanced Sampling programming
- Status—Lists all current sampling status, power supply voltage, and values of any data channels that are enabled.
- Display Data—Shows graphs and tables of logged data (Displaying Data on page 112)
- Options—Optional Device Programming

Setup and Option functions lead to sub-menus and will configure the basic and advanced features of the sampler. Refer to the Quick Start Guides on page 103. The Display Data and Status Menus lead to sub-menus and will provide information only. Press **STATUS** to display any data channels that have enabled logging (flow, pH, temp., etc.)

3.2 Basic Programming Setup

Basic programming setup must be performed, step-by-step and in its entirety, after the instrument is installed. Refer to the Quick Start Guides on page 103 for more information. The basic program setup will modify the following items:

- Bottles
- Program Lock
- Sample Collection
- Liquid Sensor
- Intake Rinses
- Site ID
- Intake Tubing
- Program Delay
- Sample Distribution
- Sample Volume
- Sample Retries

In addition, several advanced sampling features are found on a sub-menu called Advanced Sampling. Refer to section 3.3 on page 46 for Advanced Sampling Basic Programming Setup.

To make changes to the program entries after the basic programming setup, press the **MAIN MENU** key and select **SETUP>MODIFTY SELECTED ITEMS** and highlight the program entry using the **UP** and **DOWN** keys.

To review all information in the Setup and Option menus without worrying about accidentally changing the information. Use the Review All Items function to verify that the program is setup properly. For more information on this function refer to Review All Items on page 111.

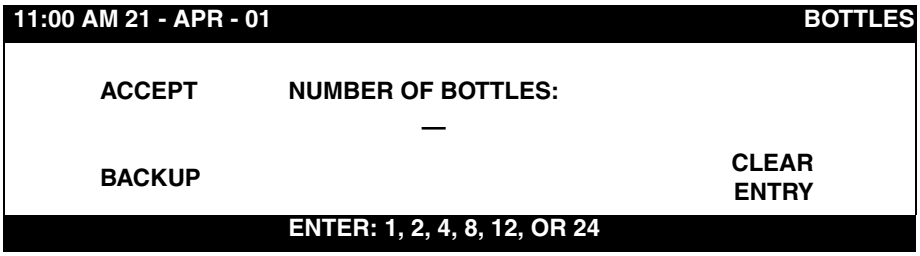
1. Press **SETUP** from the Main Menu to prepare the instrument for use.

2. From the Main Menu select **SETUP>MODIFY ALL ITEMS**.

3. Press **ACCEPT** to begin setting up the Bottles.

Step 1 - Bottles

1-A. Enter the total number of sample bottles in the refrigeration compartment, using the numeric keypad.



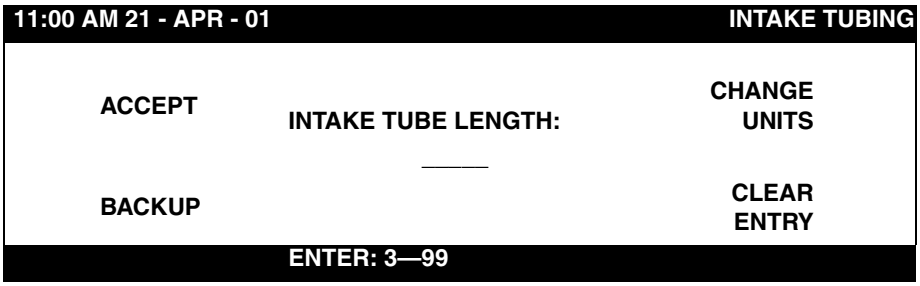
Note: *The bottles may be installed directly in the refrigeration compartment or in the removable bottle tray when using sets greater than four bottles.*

1-B. Press **ACCEPT** to continue and move to the Bottle Volume menu.

1-C. Enter the bottle volume and select gallons or milliliters using the **CHANGE UNITS** key.

1-D. Press **ACCEPT** and continue to Intake Tubing.

Step 2 - Intake Tubing



2-A. Enter the intake tube length of the intake tubing attached to the sampler. Length values from 100 to 3000 cm (3 to 99 ft) are valid. Change the measurement unit using the **CHANGE UNITS** key.

Note: *Intake tube length affects sample volume accuracy, cut the tubing to the nearest whole foot. Avoid excessively long tubing runs. Doubling the intake tubing length can quadruple the pump tubing wear if intake rinses or sample retries are enabled. Always locate the sampler close to the sample liquid source to minimize tubing, pump, motor, and gearbox maintenance.*

2-B. Press **ACCEPT** to move to the Intake Tube Type menu.

2-C. Select the type of intake tube (3/8 in. Vinyl, ¼ in. Vinyl, 3/8 in. Teflon®) using **CHANGE UNITS** key.

2-D. Press **ACCEPT** to select the intake tube type and continue with Program Lock.

Step 3 - Program Lock

Note: *The program lock password is configured at the factory as **"9000"** and cannot be changed.*

Enabling the Program Lock will provide a protective "password" which will keep unauthorized personnel from tampering with the instrument keypad.

3-A. Enable or Disable Program Lock using the **CHANGE CHOICE** key.

Note: *When program lock is enabled and a user attempts to make a change in the program, a screen will ask the operator to enter the password. The operator must enter 9000 and press **ACCEPT**.*

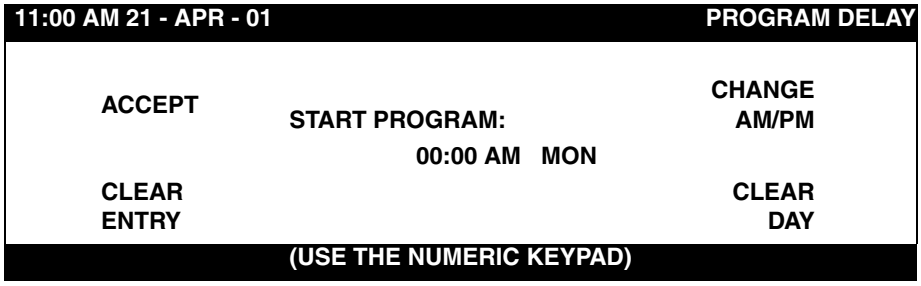
3-B. Press **ACCEPT** to continue the basic program setup and continue with Program Delay.

Step 4 - Program Delay

Note: *If both Setpoint Sampling and Program Delay are enabled, the program delay is evaluated first, prior to any checking for setpoint conditions.*

4-A. Enable or Disable Program Delay using the **CHANGE CHOICE** key. Enabling the Program Delay will cause the sampling program to delay starting until a user specified time and day of week are programmed.

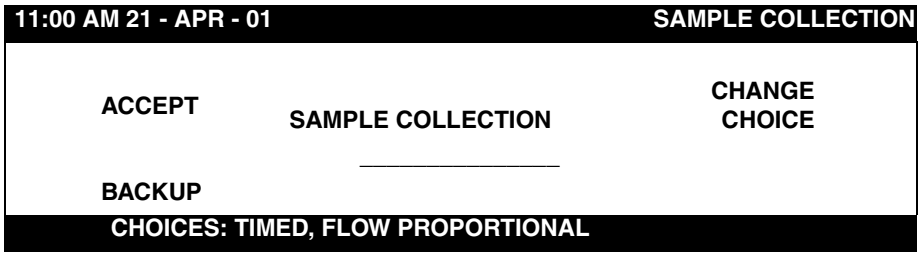
4-B. After enabling the program delay, enter the time and day of week that the program will begin. Use the soft keys to change the day of week as well as the AM/PM indicator.



4-C. Press **ACCEPT** to continue with Sample Collection.

Step 5 - Sample Collection

5-A. Select the type of sample collection; Time Proportional, Flow- Proportional Constant Volume, Variable Time (CVVT), or Flow-Proportional Constant Time, Variable Volume (CTVV).

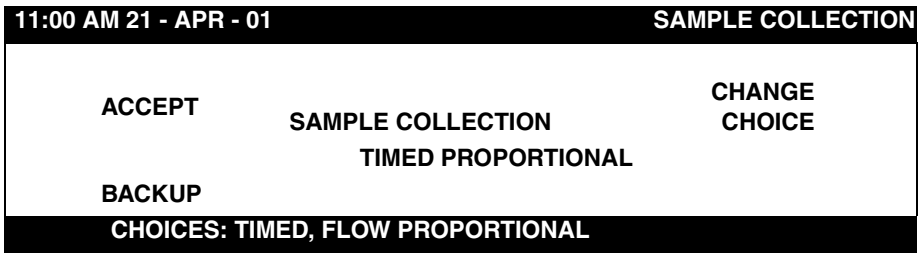


Timed-Proportional Sampling Intervals

When the program starts, a sample is taken immediately or delayed until after the first interval has elapsed. Select either, Take First Sample Immediately or After the First Interval.

Timed-Proportional samples are taken each time a user defined time interval has elapsed. Samples can be continually taken at that interval until the completion of the program.

a. From the Sample Collection menu, press **CHANGE CHOICE** until Timed Proportional is displayed. Press **ACCEPT** to continue.



b. Enter the Interval Between Samples. Press **ACCEPT** to continue.

11:00 AM 21 - APR - 01		SAMPLE COLLECTION
ACCEPT	INTERVAL:	
CANCEL	00:00 (hrs:min)	CLEAR ENTRY
ENTER: 000:01—999.00 (hrs:min)		

c. Select Take First Sample Immediately or After The First Interval?

Note: *When the program is started, the first sample is taken immediately upon pressing the start button or after the first interval has elapsed.*

11:00 AM 21 - APR - 01		SAMPLE COLLECTION
ACCEPT	TAKE FIRST SAMPLE:	CHANGE CHOICE
CANCEL	_____	
CHOICES: IMMEDIATE, AFTER 1st SAMPLE		

d. Press **ACCEPT** to continue to Sample Distribution.

Flow Proportional Constant Volume, Variable Time (CVVT)

CVVT sampling is a flow-proportional method of sampling. CVVT samples are taken when a user-defined flow volume occurs in the flow stream. This occurs when the sampler is programmed to take a sample every time a specified volume of flow occurs in the flow stream. Specified flow volume intervals can vary with the flow rate of the stream, therefore varied time intervals can occur when constant (fixed) volume occurs.

Flow volume is determined internally, by the optional integral flow meter or by an external flow meter.

a. In the Sample Collection, press **CHANGE CHOICE** until Flow Proportional is displayed. Press **ACCEPT**.

11:00 AM 21 - APR - 01		SAMPLE COLLECTION
ACCEPT		CHANGE UNITS
	SAMPLE COLLECTION: FLOW-PROPORTIONAL	
CANCEL		
ENTER: 1.00 - 99999999		

b. In the Flow Proportional menu, press **CHANGE CHOICE** until Constant Volume, Variable Time is displayed. Press **ACCEPT**.

11:00 AM 21 - APR - 01		FLOW PACING
ACCEPT		CHANGE CHOICE
	FLOW PACING MODE: CONST VOL / VAR TIME	
CANCEL		
CHOICES: VAR T / CST VOL, CST T / VAR VOL		

c. Select either Integral or External flow meter and press **ACCEPT**.

d. Enter the flow volume between samples and select a unit of measure using the **CHANGE UNITS** key, then press **ACCEPT**. Refer to Table 4 for flow unit choices.

11:00 AM 21 - APR - 01		SAMPLE COLLECTION
ACCEPT	TAKE SAMPLE EVERY:	CHANGE UNITS
	1500 gal	
CANCEL		CLEAR ENTRY
ENTER: 1.00—99999999		

Table 4 Sampler Pacing Flow Units

Abbreviation	Volume
gal	gallons
ltr	liters
m^3	cubic meters
af	acre-feet
cf	cubic feet

e. Enable or Disable Timed Over-Ride using the **CHANGE CHOICE** key. Press **ACCEPT**, then enter a time period using the numeric keypad.

Note: *Select Timed Over-Ride if the flow rate drops to an unusually low value during flow-proportional sampling and if the sample is collected once an hour for example, even if the flow interval has not elapsed.*

11:00 AM 21 - APR - 01		SAMPLE COLLECTION
ACCEPT	TIMED OVER-RIDE:	
	00:00 (hrs:min)	
CANCEL		CLEAR ENTRY
ENTER: 000:01 — 999:00 (hrs:min)		

f. Select Take First Sample Immediately or After First Interval?

Note: *When the program is started, the first sample is taken immediately upon pressing the start button or after the first interval has elapsed.*

11:00 AM 21 - APR - 01		SAMPLE COLLECTION
ACCEPT		CHANGE CHOICE
	TAKE FIRST SAMPLE:	
	_____	
CANCEL		
CHOICES: IMMEDIATE, AFTER 1st SAMPLE		

g. Press **ACCEPT** to continue to Sample Distribution.

Flow Proportional Constant Time, Variable Volume Sampling (CTVV)

A Level-Velocity Sensor Input must be logged and electrically connected for the CTVV feature to work correctly.

CTVV samples are taken at user-specified constant (fixed) intervals. However the actual volume of each sampling is based on the known average flow rate of the site, the actual metered flow rate for each specific interval, the total sample volume desired, the user-specified collection period, and the specified Sampling Interval. Depending on the flow volumes of a stream and various intervals within the Collection Period, the volume of individual sampling can vary. Also, the total sample collected during the entire period can carry slightly above or below the Total Volume Desired. For these reasons, the manufacturer advises using a sampling container that has a larger volume than the Total Volume Desired value.

- Sample Distribution menus are not available when CTVV is selected.
- A level-velocity sensor input must be logged and electrically connected for the CTVV feature to correctly work.
- The Flow Pacing Mode menu within the Flow Proportional menus sequence will not remember the previous setting whenever you re-enter this menu, it will revert to the CVVT default. When re-entering this menu, press **CHANGE CHOICE** to select the sampling method, CVVT or CTVV.

Example:
This is an example of how the instrument determines sample volume, based on user inputs and actual metered flow volume.

The user entered values are the following:

- Average Flow Rate (historical, site specific): 150 gph
- Sampling Interval: 2 minutes
- Total Sample Volume Desired: 1500 mL
- Collection Sampling Period: 30 minutes

Calculation 1: Total Number of Samples

$$\frac{\text{Sample Period}}{\text{Sampling Interval}} = \frac{30 \text{ min.}}{2 \text{ min.}} = 15 \text{ samples total within specified period}$$

Calculation 2: Average Sample Volume

$$\frac{\text{Total Sample Volume Desired}}{\text{Total Number of Samples}} = \frac{1500 \text{ mL}}{15 \text{ samples Total}} = 100 \text{ mL/sample}$$

Calculation 3: Sample's Volume per unit of Flow Rate

$$\frac{\text{Avg. Sample Volume}}{\text{Avg. Flow Rate}} = \frac{100 \text{ mL/Sample}}{150 \text{ gph}} = 0.7 \text{mL/gph}$$

Calculation 4: Actual Sample Volume to be Collected

Sample Volumes per unit of Flow Rate $\times$ Actual metered Flow Rate

$0.7 \text{ mL/gph} \times 150 \text{ gph} = 105 \text{ mL for this sample interval}$

a. In the Sample Collection menu, press **CHANGE CHOICE** until Flow Proportional is displayed. Press **ACCEPT**.

11:00 AM 21 - APR - 01		SAMPLE COLLECTION
ACCEPT	SAMPLE COLLECTION: FLOW-PROPORTIONAL	CHANGE UNITS
CANCEL		
ENTER: 1.00 - 99999999		

b. In the Flow Pacing menu, press **CHANGE CHOICE** Const Time/Var Vol appears. Press **ACCEPT**.

11:00 AM 21 - APR - 01		FLOW PACING
ACCEPT	FLOW PACING MODE: CONST TIME/ VAR VOL	CHANGE CHOICE
CANCEL		
CHOICES: VAR T / CST VOL, CST T / VAR VOL		

c. In the Average Flow Rate menu use the numeric keypad to enter the known historical Average Flow Rate for a particular site.

11:00 AM 21 - APR - 01		CONST TIME/ VAR VOL
ACCEPT	AVERAGE FLOW RATE: 150.00 gph	
CANCEL		CLEAR ENTRY
ENTER: 1.00—99999999		

d. In the Interval menu use the numeric keypad to enter the time interval between sample collections. Press **ACCEPT**.

11:00 AM 21 - APR - 01		CONST TIME/ VAR VOL
ACCEPT	INTERVAL: 0:02 (hrs:min)	
CANCEL		CLEAR ENTRY
ENTER: 1.00—999:00 (hrs:min)		

e. In the Total Volume Desired menu use the numeric keypad to enter the total volume of the sample. Press **ACCEPT**.

11:00 AM 21 - APR - 01		CONST TIME/ VAR VOL
ACCEPT	TOTAL VOLUME DESIRED: 1500 Ml	
CANCEL		CLEAR ENTRY
ENTER: 10—9999		

f. In the Collection Period menu use the numeric keypad to enter the time period for collecting samples.

11:00 AM 21 - APR - 01		CONST TIME/ VAR VOL
ACCEPT	COLLECTION PERIOD 0:30 (hrs:min)	
CANCEL		CLEAR ENTRY
ENTER: 000:01—999:00 (hrs: min)		

g. Press **ACCEPT** to continue to Sample Distribution.

Step 6 - Sample Distribution

Sample distribution describes the way samples are deposited in a bottle(s). Several bottle combinations are available with the sampler (Figure 10 on page 24). Sample distribution is deposited into a single bottle or multiple bottles. Multiple bottle applications use a distributor arm to automatically aim the sample intake tubing into the proper bottle. Multiple bottle sets deliver each sample to all bottles or deliver each sample into individual bottles or a subset of bottles.

Single Bottle

6-A. Select either Stop After Last Bottle or Run Continuously? Stop After Last Bottle mode stops the program when the sample is deposited into the last bottle. Run Continuously mode continues running until it is manually stopped.

11:00 AM 21 - APR - 01		SAMPLE DISTRIBUTION
ACCEPT	RUN MODE: RUN CONTINUOUSLY	CHANGE CHOICE
CANCEL		
CHOICES: CONTINUOUS, STOP AFTER LAST		

6-B. Press **ACCEPT** to continue to Liquid Sensor setup.

Multiple Bottle Sets

Multiple bottle applications use a distributor arm to automatically aim the sample intake tubing into the proper bottle. Multiple bottle sets deliver each sample to all bottles or deliver each sample into individual bottles or a subset of bottles.

6-A. Select **YES** or **NO** for Deliver Each Sample to All Bottles.

11:00 AM 21 - APR - 01		SAMPLE DISTRIBUTION
ACCEPT	DELIVER EACH SAMPLE TO ALL BOTTLES?	CHANGE CHOICE
CANCEL	NO	
CHOICES: YES, NO		

If **NO** is selected:

a. Select Samples per Bottle or Bottles per Sample.

Example 1: Samples Per Bottle

- Bottles—8
- Sample Collection; Time-Proportional; Sampling Interval—30 min.
- Sample Distribution; Deliver Each Sample to All Bottles?— No
  Samples Per Bottle— Yes
  Number of Samples Per Bottle— 3
- Sample Volume—100 mL

Every 30 minutes a sample is initiated. A 100 mL sample is drawn into bottle #1, 30 minutes later a second sample is drawn into bottle #1, 30 minutes later a third sample is drawn into bottles #1. Thirty minutes later the distributor arm advances to bottle #2 and a 100 mL sample is drawn into bottle #2. The sequence continues until all bottles are filled. Each bottle receives three samples before the distributor moves to the next bottle.

Example 2: Bottles Per Sample

- Bottles—4
- Sample Collection; Timed Proportional; Sampling Interval—30 min.
- Sample Distribution; Deliver Each Sample to All Bottles?—No
  Bottles Per Sample—Yes
  Number of Bottles Per Sample—2
- Sample Volume—1000 mL

Note: *A high pressure air purge is automatically applied to the intake tube between each sample intake cycle.*

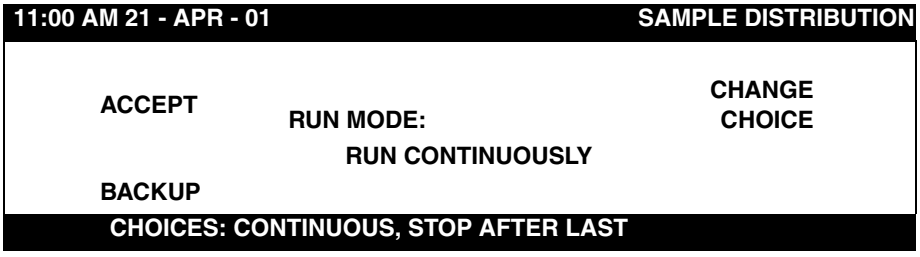
Every 30 minutes a sample cycle is initiated. A 1000 mL sample is drawn into the first bottle. the distributor arm immediately advances to bottle #2 and a 1000 mL sample is drawn into the second bottle. Thirty minutes later, the distributor arm advances to bottle #3, and a 1000 mL sample is taken. The distributor arm immediately advances to bottle #4 and a 1000 mL sample is drawn into the fourth bottle. The pattern continues each sample cycle with each set of two bottles receiving a sample each time.

b. Press **ACCEPT** to continue with Liquid Sensor setup.

If **YES** is selected:

Each time a sample is taken it is consecutively placed in all bottles. This allows for split samples.

a. Select Stop After Last Sample or Run Continuously.



b. If Stop After Last Sample is chosen, enter the samples to collect using the numeric keypad.

Example 1: The following example creates four identical composite samples automatically if the sampler is programmed as follows:

- Bottles—4
- Sample Collection; Sampling Interval—30 minutes
- Sample Collection; Samples to Collect—25
- Sample Volume—100 mL

Every 30 minutes a sample is initiated and a 100 mL sample is drawn into the first bottle. The distributor arm advances to bottle #2 and 100 mL. sample is drawn into the second. This also occurs in bottles #3 and #4.

Sampling will continue every 30 minutes until 25 samples are deposited. Once all samples are deposited the program will terminate. If Run Continuously is selected the sampling will restart automatically.

c. Press **ACCEPT** to continue to Liquid Sensor.

Step 7 - Liquid Sensor

The liquid sensor contains a pair of ultrasonic transducers which sense the presence of liquid inside silicone tubing.

7-A. Enable or Disable Liquid Sensor using the **CHANGE CHOICE** key.

Note: *Sample retries cannot be enabled when the liquid sensor is disabled.*

Enabling the Liquid Sensor
When the liquid sensor is enabled, the sampler will perform two duties:

- It senses when liquid reaches the pump during an intake cycle. The pump then reverses to rinse the line, up to 3 times.
- It senses the absence of liquid during a sample intake cycle if the intake tubing is plugged or if the water level has dropped below the level of the intake tube strainer. This initiates a Sample Retry if programmed

Disabling the Liquid Sensor/Timed Calibration
Disabling the liquid sensor turns the liquid sensor off. The sample volume is then metered using a timed method (Timed Calibration), instead of a sensed method.

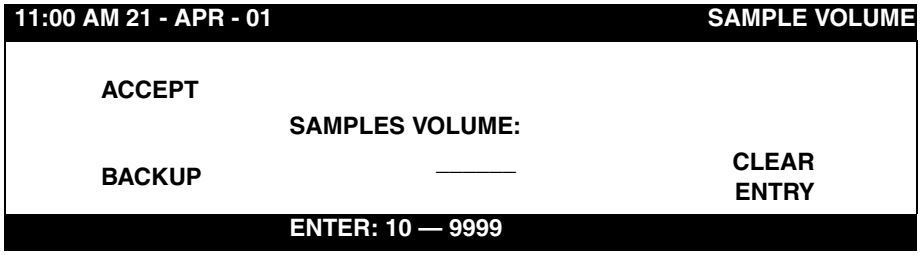
7-B. Press **ACCEPT** to continue to Sample Volume.

Step 8 - Sample Volume

Note: *The minimum sample volume is ten milliliters.*

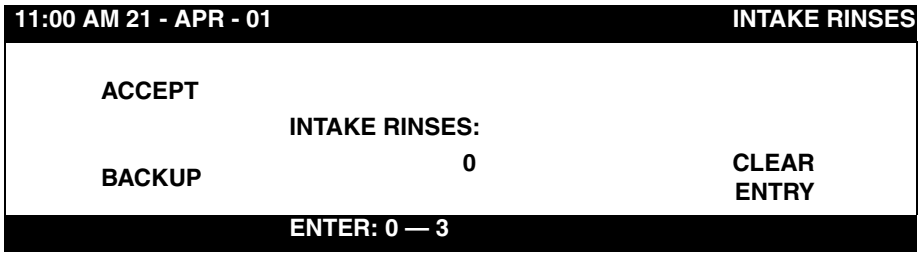
When multiple bottles are selected in Bottle Per Sample mode all bottles in a subset receive a full sample volume. The volume is not divided among the bottles.

8-A. Enter the desired volume of each sample using the numeric keypad. Press **ACCEPT** to continue to Intake Rinses.



Step 9 - Intake Rinses

9-A. Enter number of rinses using the numeric keypad.



Up to three intake rinses are enabled per sample cycle. After the sample cycle's initial purge has been completed, the sample liquid is drawn in until it reaches the liquid sensor. The pump stops and purges the line before any liquid enters the bottle. This is repeated up to three times before the actual sample is taken and the line purged for the final time during that cycle.

Intake rinse can prevent cross contamination of samples. When the line is purged at the end of each sample cycle, a few droplets of sample liquid may cling to the inside walls of the tubing and the droplets are drawn in with the following sample. Intake rinses will condition the intake line with a source liquid that minimizes contamination from the previous sample.

9-B. Press **ACCEPT** to continue to Sample Retries.

Step 10 - Sample Retries

Note: *Excessive intake tube line lengths combined with multiple Intake Rinses and Sample Retries can increase the pump tube and drive train wear. Locate the sampler as close to the sample liquid source as possible to minimize wear and maintenance requirements.*

10-A. Enter the number of Sample Retries using the numeric keypad.

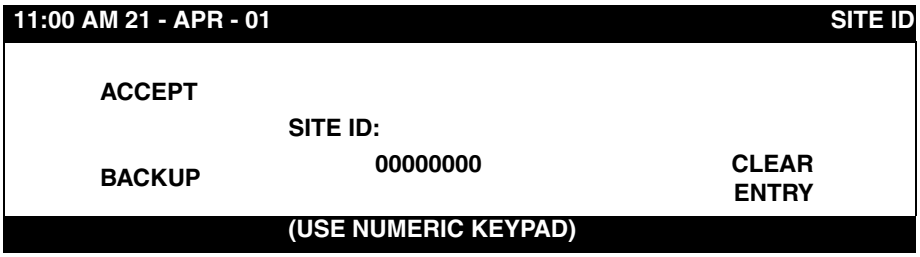
Up to three sample retries are enabled per sample cycle. After the initial purge is completed, the sample liquid is drawn until it reaches the liquid sensor. If the sample liquid does not reach the sensor within a reasonable time (determined using the tubing length), the sample attempt is aborted, a purge is initiated and the first of up to three sample retries is attempted.

After three attempts and no sample liquid has been collected, the cycle is aborted, a Missed Sample is reported to the Sample History Log, and the sampler begins a new sample interval.

10-B. Press **ACCEPT** to continue to Site ID.

Step 11 - Site ID

11-A. Enter a site identification number of up to 8 digits. This Site ID will appear on all data printouts. This feature is useful when multiple sites are monitored using a single flow meter or if data readings from multiple flow meters are collected. Press **ACCEPT**.

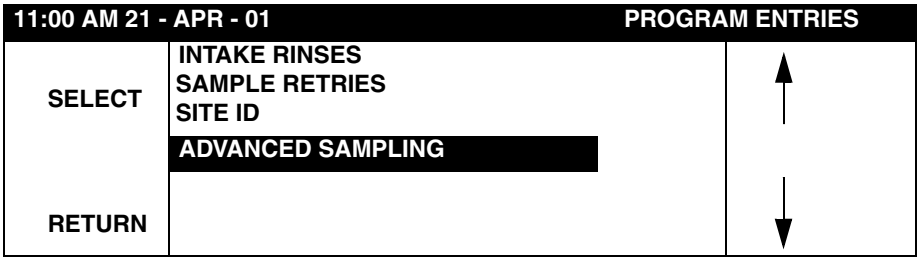


11-B. After Site ID is accepted the following menu will appear:

11-C. If **NO**, the basic setup program is complete.

Note: *To return to the Advanced Sampling options at a later time, from the Main Menu select,* ***SETUP>MODIFY SELECTED ITEMS>PROGRAM ENTRIES.***

4. Highlight Advanced Sampling and press **SELECT**. In the Advanced Sampling menu highlight the an item using the **UP** and **DOWN** keys and press **SELECT**.



11-D. If **YES**, continue to Advanced Sampling, section 3.3.

3.3 Advanced Sampling

Advanced sampling choices:

- Program Complete Output
- Setpoint Sampling
- Special Output
- Start/Stop Times
- Storm Water
- Timed Bottle Sets
- Upset Sample
- Variable Intervals
- Variable Volumes

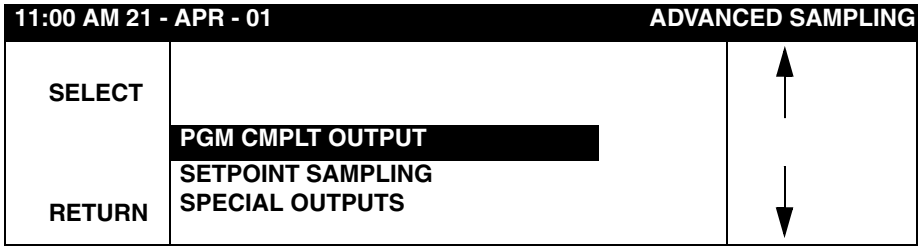
Step 12 - Program Complete Output

Program Complete Output sends a +12 V dc signal out Pin F of the Auxiliary Receptacle at the completion of the sampling program. This signal is also sent when a Full Bottle condition causes the program to complete. The Program Complete signal remains on (+12 V dc) for 61 seconds and then turns
back off (0 V dc).

Program Complete Output is used for the following purposes:

- Multiple Sampler Operation. Samplers are arranged in a “Cascade” control where the first sampler signals a second sampler to start its program when the first sampler’s program is complete. This feature requires the second sampler to be programmed for external start operation.
- To interface to a PC to signal the end of the sampling program.
- To interface to a relay that trips a signal light in a control room to indicate that sampling is finished and samples are ready to be picked up.

12-A. From the Advanced Sampling menu highlight Program Complete using the **UP** and **DOWN** keys. Press **SELECT** to continue.



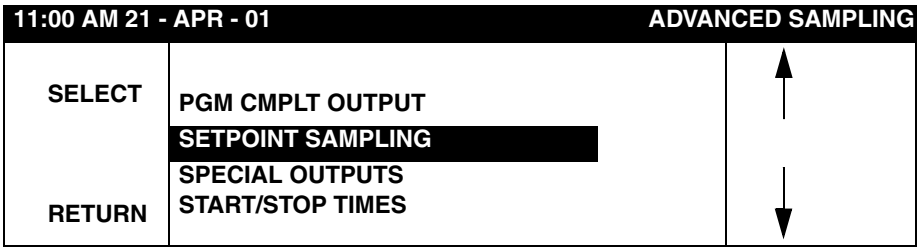
12-B. Enable or Disable Program Complete using the **CHANGE CHOICE** key.

12-C. Press **ACCEPT** to continue to Setpoint Sampling.

Step 13 - Setpoint Sampling

Setpoint sampling allows the control of an automatic liquid sampler from one of up to 14 sources. Setpoint sampling defines a set of limits that inhibit sampling until an upset condition occurs, causing the limits to exceed. Sampling is enabled only when the waste stream falls outside the setpoints.

13-A. Highlight Setpoint Sampling using the **UP** and **DOWN** keys on the Advanced Sampling Menu. Press **SELECT**.



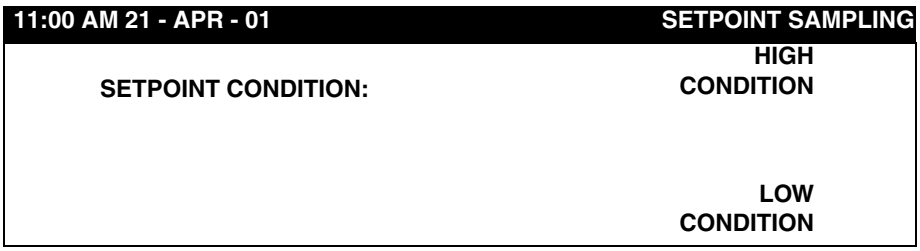
13-B. Enable or Disable Setpoint Sampling using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

13-C. Select either Start on Setpoint or Stop on Setpoint by pressing **CHANGE CHOICE**. Press **ACCEPT** to continue.

- Start on Setpoint will start a program when the setpoint condition is met. The program continues to run even if the condition falls back within the setpoint limits.
- Stop On Setpoint halts the program if the setpoint condition falls back within the setpoint limits and starts again if the limits are exceeded.

13-D. Highlight the desired channel to trigger from, then press **SELECT**.

13-E. Press either **HIGH CONDITION** or the **LOW CONDITION**.

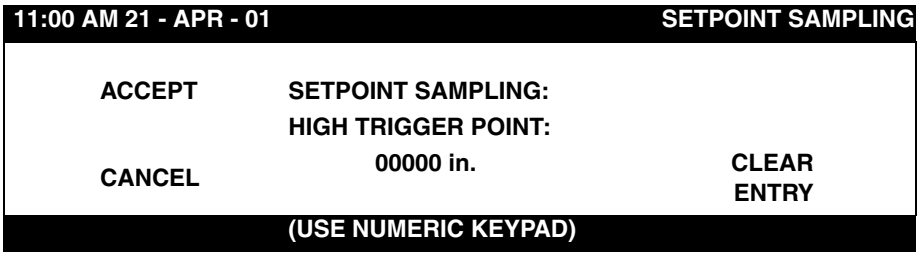


Note: *Flow Rate of Change and Rainfall are signals that only increase and never decrease in value, therefore these signals do not require Low Condition.*

The external control signal must be configured on the external equipment for the desired setpoint. An external control device must provide a dry contact and can include a float switch, push-button, external flow meter, etc. For interface connections refer to section 2.10 on page 29.

13-F. Enable or Disable the trigger point using the **CHANGE CHOICE** key.

13-G. Select the desired high or low trigger point using the numeric keypad. Press **ACCEPT** to continue. Refer to Table 5.



13-H. Enter the Deadband value if required or, if programming Flow Rate Of Change or Rainfall, enter a time interval that the flow or rainfall change must take place (refer to section 6.4 on page 87).

11:00 AM 21 - APR - 01		SETPOINT SAMPLING
ACCEPT	SETPOINT SAMPLING DEADBAND:	
CANCEL	0.000	CLEAR ENTRY
	(USE NUMERIC KEYPAD)	

13-I. Enter a delay when input is active. This delay will keep the program from starting until the end of the delay period. Using the numeric keypad, enter the delay in minutes and/or hours. Press **ACCEPT**.

11:00 AM 21 - APR - 01		SETPOINT SAMPLING
ACCEPT	DELAY WHEN INPUT BECOMES ACTIVE:	
CANCEL	(hrs:min)	CLEAR ENTRY
	(USE NUMERIC KEYPAD)	

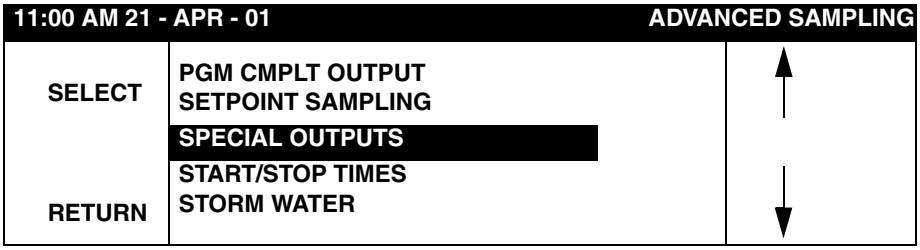
Table 5 Sampling Triggers and Settings

Channel	Sampling Trigger	Settings
1	Level	High and/or Low Condition, Deadband
2	Flow	High and/or Low Condition, Deadband
3	Flow Rate of Change	High Condition within Time Interval
4	pH or ORP	High and/or Low Condition, Deadband
5	Process Temperature	High and/or Low Condition, Deadband
6	Rainfall	High Condition within Timed Interval
7	Analog Input Channel 1	High and/or Low Condition, Deadband
8	Analog Input Channel 2	High and/or Low Condition, Deadband
9	Analog Input Channel 3	High and/or Low Condition, Deadband
10	Analog Input Channel 4 or DO	High and/or Low Condition, Deadband
11	Analog Input Channel 5 or DO Temperature	High and/or Low Condition, Deadband
12	Analog Input Channel 6 or Conductivity	High and/or Low Condition, Deadband
13	Analog Input Channel 7 or Conductivity Temperature	High and/or Low Condition, Deadband
14	External Control	Configured in External Equipment

Step 14 - Special Output

The Special Output is a +12 V dc signal that appears on Pin E of the Auxiliary Receptacle (refer to section 2.10 on page 29).

14-A. Highlight Special Output using the **UP** and **DOWN** keys on the Advanced Sampling Menu. Press **SELECT** to continue.



14-B. Enable or Disable Special Outputs using the **CHANGE CHOICE** key. Press **SELECT** to continue.

14-C. If enabled, select After Each Sample, Only When Pumping, or From Rinse to Purge.

Bottle Number
If the Program Complete Output is disabled, then it is used in conjunction with this special Output to transmit the bottle number to the connected device.

The Special Output signal can be configured to activate during one of the following conditions:

- After Each Sample– One second pulse at the completion of each sample cycle. It signals an external datalogger or PC that a sample cycle was initiated. When this choice is enabled, the sample success/failure is also transmitted to the external datalogger by means of Pin F on the Auxiliary connector.

- Only When Pumping– During sample intake portion of cycle only, ignoring all purges and rinse cycles. Used for tipping solenoid or ball valves when sampling from a pressurized line.

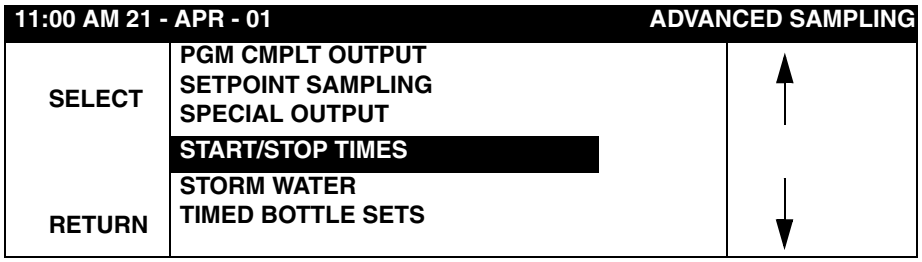
- From Rinse To Purge– During entire sample cycle, including all purge and rinse cycles. Used for tripping solenoid or ball valves when sampling from a pressurized line.

Step 15 - Start/Stop Times

Start/Stop Times start and stop a program at pre-arranged times. For example, this feature can be used to run a program during weekdays and stop the program during weekends, restarting on the following Monday. It can also halt sampling for nighttime shutdowns.

Up to 12 Start and 12 Stop time entries can be set in any one program. Either a Start Time and Date or a Start Time and Day of the Week may be selected.

15-A. Highlight the Start/Stop Time choices on the Advanced Sampling menu. Press **SELECT** to continue.

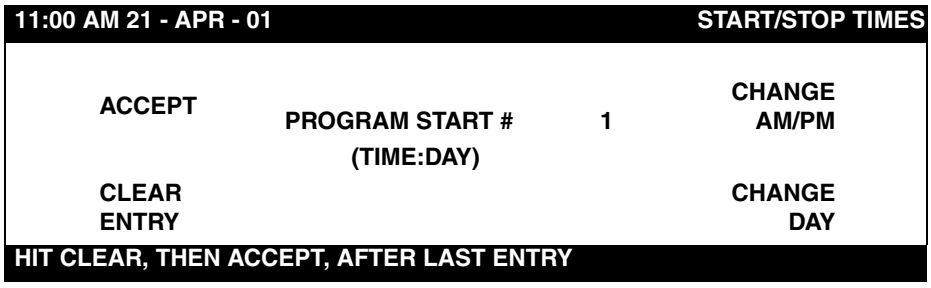


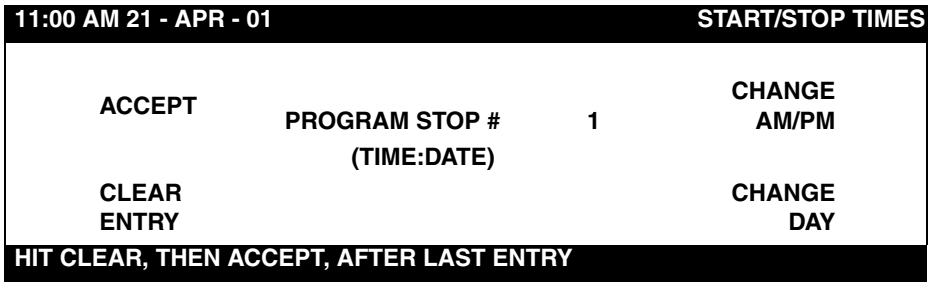
15-B. Enable or Disable Start/Stop Times using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

15-C. Press **CHANGE CHOICE** to select either Time/Date or Time/Weekday. Select Time/Date if the start and stop times cover longer than a week. Select Time/Weekday if the program repeats on a daily or weekly basis.

15-D. Press **ACCEPT** to continue.

15-E. Enter the Start Time #1, press **ACCEPT** to continue. Enter Stop Time # and press **ACCEPT** to continue.





15-F. Continue entering Start and Stop times until finished. To exit and save entries, enter a blank time and date. Press **CLEAR ENTRY** and then press **ACCEPT** to continue to Storm Water.

Step 16 - Storm Water

EPA regulations for storm water discharges require monitoring of precipitation, flow, and water samples in order to assess the impact of storm or snow melt runoff on receiving waters. The manufacturer can help you create a storm water monitoring system that consists of a multiple bottle sampler, an external flow meter, and a tipping bucket rain gauge.

In addition to performing basic sampling routines, samplers that are equipped with the storm water monitoring program have the following additional capabilities:

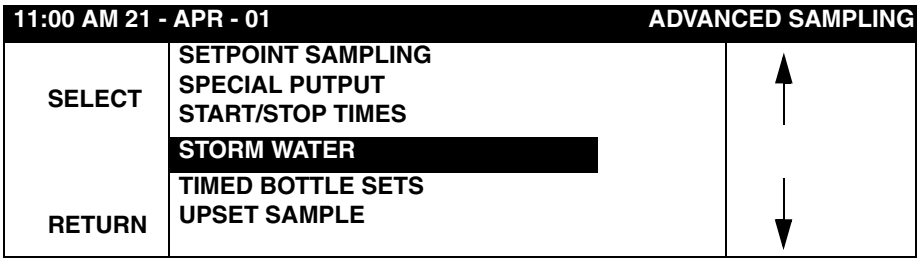
- The storm water sampling routine allows collection of automatic grab sample(s) at user-selectable timed intervals (up to 24 different intervals may be selected) during the storm's early stage or “first flush.” First flush grab and main program flow-weighted composite samples are automatically segregated. The first flush sample volume may be set independently of the sample volume for the flow-weighted composite.

- The special storm water program allows an external device to initiate the start of the sampling program. A dry contact closure across Pins B and D on the Auxiliary receptacle, held closed for at least 61 seconds, is required.

- When sampling with multiple bottles, the sampler can be programmed to collect one large “first flush” sample (or small multiple samples) at timed interval(s). The number of bottles segregated for the first flush sample is selectable. Concurrently, flow-weighted samples are collected from the beginning of the storm until all remaining bottle(s) are filled, or after a user selected time has elapsed.

- Storm water samplers are equipped with a special prerinse that occurs only with the first sample collection. This “one time only” rinse ensures a clean intake for installations that may remain dormant for extended periods, and extends battery life by eliminating the prerinse for subsequent samples.

16-A. Highlight Storm Water using the **UP** and **DOWN** keys on the Advanced Sampling Menu. Press **SELECT** to continue.



16-B. Enable or Disable Storm Water using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

16-C. Select a Start Condition using the **CHANGE CHOICE** key.

- Rain
- Level
- Rain or Level (either condition must be met for the program to begin)
- Rain and Level (both conditions must be met for the program to begin)
- Immediate (program starts as soon as the **RUN** key is pressed, a start condition is not required)
- External Trigger (program starts when signaled by an external device at least 61 seconds through the Auxiliary connector. No start condition is required).

16-D. Enter the Start Condition Limits. Rainfall times will depend on the historical rainfall in a specific area. Consult your state or an EPA regional office for details.

Table 6 Start Condition Requirements

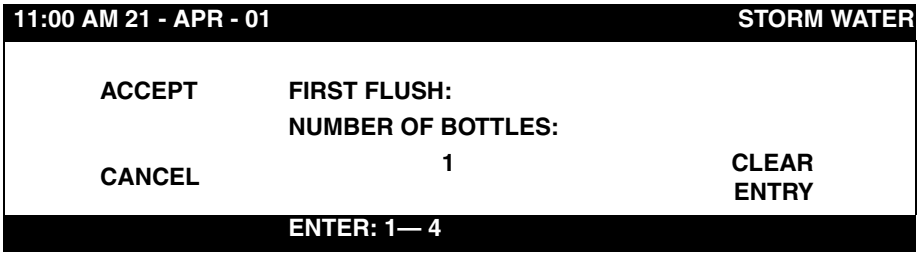
Rain	Enter the amount of rainfall and the time period when it must fall.
Level	Level Limit
Rain and Level	Enter the amount of rainfall and the time period when it must fall, and desired level limit.
Immediate	No start condition required
External Trigger	No start condition required

First Flush Bottles

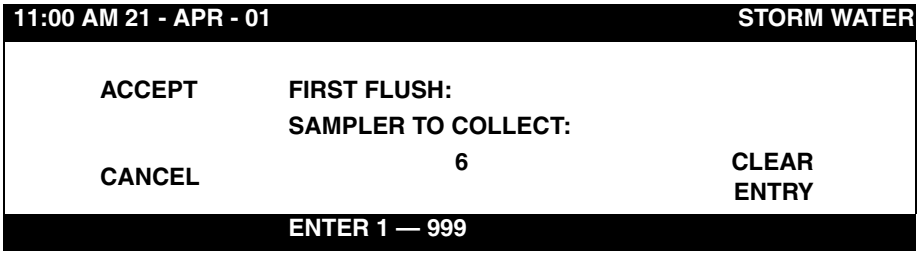
First flush describes the initial storm water runoff. This runoff may contain higher concentrations of pollutants and is sequestered in separate bottles from the flow or time-weighted composite samples.

a. Enter the number of bottles to set aside for the First Flush portion of the sampling program using the numeric keypad.

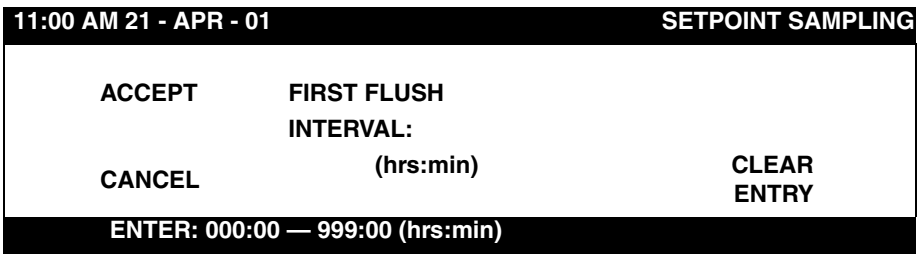
The number of first flush bottles will depend on the sample volume requirements in your NPDES permit.



b. Enter number of samples to collect using the numeric keypad.

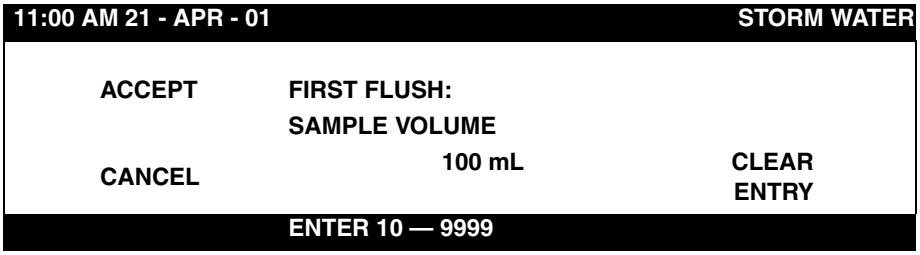


c. Enter the first flush sampling interval. This is the time period between sample cycles. The first flush samples are usually collected within thirty minutes of the storm.



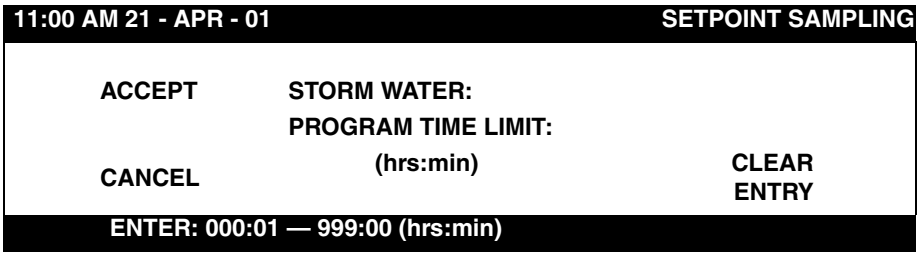
Variable time intervals may be entered or the same interval may be carried through the entire first flush. Pressing **FINAL ENTRY** carries the last displayed interval through the remainder of the first flush sampling period.

d. Enter the first flush sample volume using the numeric keypad.



e. Enable or Disable Program Time Limit using the **CHANGE CHOICE** key. When enabled, the Program Time Limit will stop all sampling activity at the end of the time limit, however data logging will continue.

f. Enter the Program Time Limit. NPDES requirements typically ask that you monitor the first three hours of any given storm. If the flow volume was not as high as expected, flow-weighted sampling could continue for some time as flow rates drop off and sample intervals become longer.



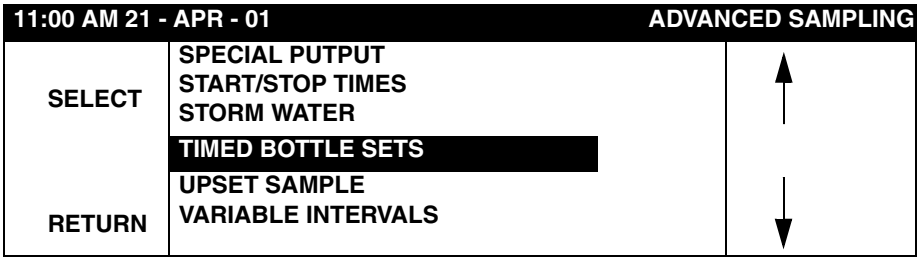
g. Press **ACCEPT** to continue to Timed Bottle Sets.

Step 17 - Timed Bottle Sets

Timed Bottle Sets enables a single sampler to function like multiple samplers. With Timed Bottle Sets you can take a 24-bottle sampler and sample using the first 12 bottles on the first day and the second 12 bottles on the next day.

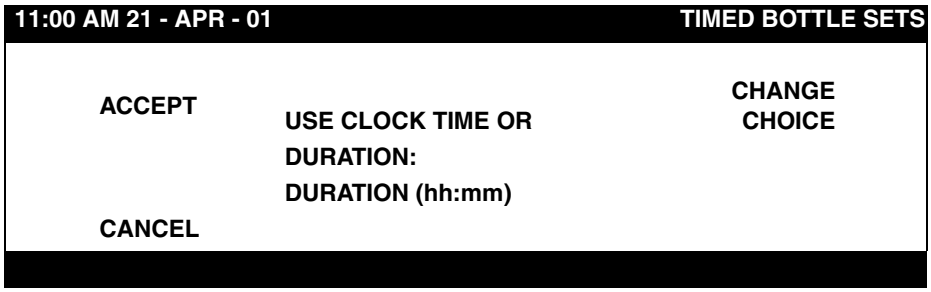
When a subset of bottles is set aside for each user defined time interval the sampler will treat that subset as if it were the entire set. At the end of the time interval the sampler will switch to the next subset and continue sampling.

17-A. Highlight Timed Bottle Sets using the **UP** and **DOWN** keys on the Advanced Sampling Menu. Press **SELECT** to continue.



17-B. Enable or Disable Timed Bottle Sets using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

17-C. Select a method for switching bottle sets. Select either clock time that switches bottle sets every 24 hours or select duration that sets the bottles sets in minutes and hours.



The number of bottles that were selected in bottles-per-sample mode are used as the bottle set size. Two bottles per-sample means two bottles per Timed Bottle Set.

17-D. Enable or Disable Continuous Mode using the **CHANGE CHOICE** key. If Continuous Mode is enabled the program will continuously run and switch bottle sets after every specified duration elapses, until manually stopped. If Continuous Mode is disabled, then the sampling halts when the last bottle set in the tray is full.

17-E. Press **ACCEPT** to continue to Upset Sample.

Step 18 - Upset Sample

Upset Sampling analyzes the collected samples to determine when samples meet or exceed specified upset limits. The sampler will swing the distributor arm around to a sequestered set of bottles and grab an upset bottle.

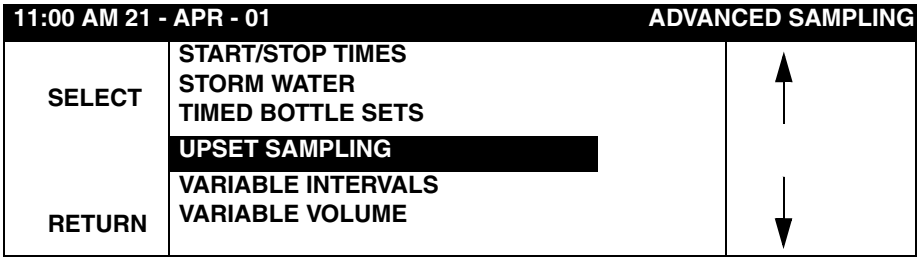
The upset sample bottles are always the last bottles in the tray. For example, if there are 24 bottles in the tray, 4 first flush bottles and 4 upset bottles, then the bottles assignment is 1–4 first flush, 5–20 main program, and 21–24 upset samples.

Note: *Unlike Setpoint Sampling, Upset Sampling can be enabled while the sampler is performing a regular sampling program. There must be more than one bottle in the sampler to perform Upset Sampling.*

Upset Samples are collected even when there are no more regular samples to be taken; when the status screen says Program Complete, but the bottom line of the display says Program Running.

Refer to the Quick Start Guides on page 103 for more setup information for individual channels.

18-A. Highlight Upset Sampling using the **UP** and **DOWN** keys on the Advanced Sampling Menu. Press **SELECT** to continue.



18-B. Enable or Disable Upset Sampling using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

18-C. Press **CHANGE CHOICE** to select the desired channel to trigger from. Press **ACCEPT** to make the selection.

18-D. Press either **HIGH CONDITION** or **LOW CONDITION**.

- Flow Rate of Change and Rainfall are signals that only increase in value and do not require Low Condition.
- The external control signal (such as an external flow meter) must be configured in the external equipment for the desired setpoint.

11:00 AM 21 - APR - 01	UPSET SAMPLES
UPSET CONDITION:	HIGH CONDITION
	LOW CONDITION

18-E. Enter the desired high or low trigger point using the numeric keypad. Press **ACCEPT** to continue.

11:00 AM 21 - APR - 01		UPSET SAMPLES
ACCEPT	UPSET SAMPLING:	
	HIGH TRIGGER POINT:	
CANCEL	00000 in.	CLEAR ENTRY
	(USE NUMERIC KEYPAD)	

18-F. Enter the Deadband value or, if programming for Flow Rate Of Change or Rainfall, enter a time interval when the flow or rainfall change must take place (refer to Alarm Relays Programming on page 89).

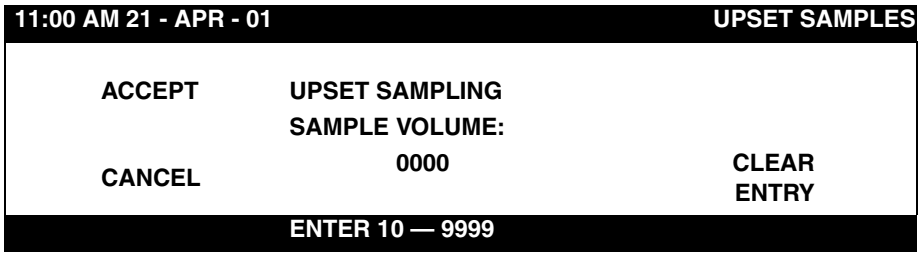
11:00 AM 21 - APR - 01		UPSET SAMPLES
ACCEPT	UPSET SAMPLING	
	DEADBAND:	
CANCEL	0.000	CLEAR ENTRY
	(USE NUMERIC KEYPAD)	

18-G. Enter the number of bottles (out of the total set) to set aside for upset samples. These will be the last bottles in the tray.

11:00 AM 21 - APR - 01		UPSET SAMPLES
ACCEPT	UPSET SAMPLING:	
	NUMBER OF BOTTLES	
CANCEL	2	CLEAR ENTRY
	ENTER 1 — 4	

18-H. Select the method of distribution, Sample Per Bottle or Bottles Per Sample.

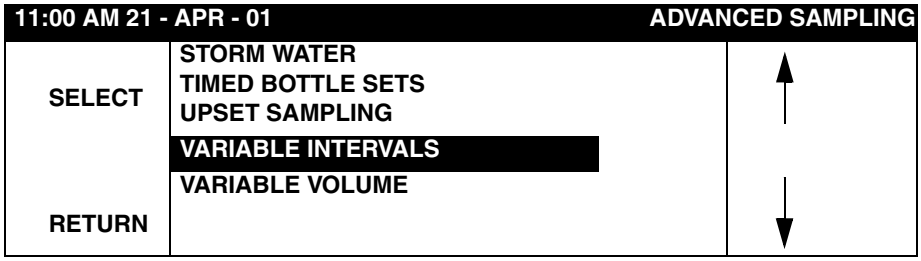
18-I. Enter the sample volume using the numeric keypad.



18-J. Press **ACCEPT** to continue to Variable Intervals.

Step 19 - Variable Intervals

19-A. Highlight Variable Intervals using the **UP** and **DOWN** keys on the Advanced Sampling Menu. Press **SELECT** to continue.

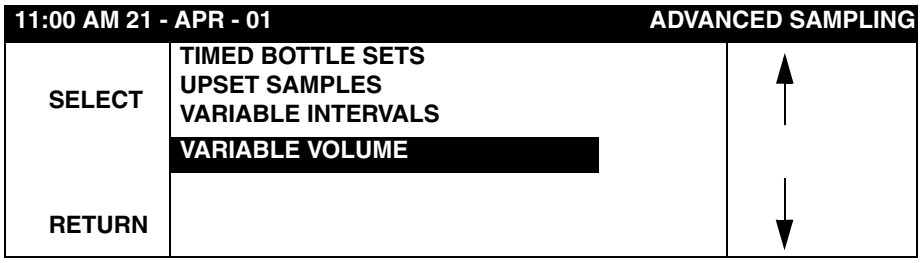


19-B. Enable or Disable Variable Intervals using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

19-C. Set sample intervals using the numeric keypad. Press **ACCEPT** to enter another interval or press **ACCEPT AS FINAL** to return to the Advanced Sampling menu and continue to Variable Volumes.

Step 20 - Variable Volume

20-A. Highlight Variable Volume using the **UP** and **DOWN** keys on the Advanced Sampling Menu. Press **SELECT** to continue.



20-B. Enable or Disable Variable Volume using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

20-C. Enter the Sample Volume counts using the numeric keypad. Press **ACCEPT** to return to the Advanced Sampling Menu.

4.1 Downlook Ultrasonic Sensor

The sampler uses a 40 kHz Downlook Ultrasonic Sensor.

4.1.1 Downlook Ultrasonic Sensor Connection

The downlook ultrasonic sensor connection is located on the back side of the sampler cabinet. The gray rectangular box houses the ultrasonic module and the transducer connector labeled ULTRASONIC. The connector is keyed and can only be inserted in the proper orientation (key up).

4.1.2 Downlook Ultrasonic Sensor Programming

The downlook ultrasonic sensor does not require specific programming, unless more than one sensor option is connected to the sampler. When more than one sensor option is connected to the sampler:

1. From the Main Menu, select **OPTIONS>LEVEL SENSOR.**
2. Select Ultra-Sonic using the **CHANGE CHOICE** key, then press **ACCEPT**.

4.1.3 Downlook Ultrasonic Sensor Calibration

Calibrate the current water level via one of two methods; Liquid Depth or Sensor Height. An Invisible Range can also be set which allows the transducer to ignore reflections from obstructions between the sensor and the water surface, such as ladder rungs, channel side walls, etc. Each method has its own advantages and disadvantages; selecting the proper method will depend upon the site conditions. Calibrate the ultrasonic sensor each time the sensor is installed at a new site.

4.1.3.1 Liquid Depth

This method requires the level or depth of liquid in the channel that is contributing to flow. In a round pipe, the entire depth typically contributes to flow. In a weir, only the depth that is flow over the weir plate contributes to flow. Many flumes have specific requirements. Level Depth calibration is primarily is used when:

- Access is available to the primary device for a physical measurement of the liquid depth, and
- When water is flowing during installation (channel is not dry).

Note: *Always re-check the Level Adjust when re-installing the flow meter.*

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>CALIBRATION>ULTRASONIC SENSOR.**
2. Select Calibrate U-Sonic using the **UP** and **DOWN** keys. Press **SELECT**.
3. Select Standard as the type of Ultrasonic Transducer using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

Temperature Time Constant

The speed of sound in air varies with the temperature of the air. The ultrasonic sensor is equipped with temperature compensation to help eliminate the effect of temperature variation under normal site conditions. The transducer must be equal to the ambient air temperature at the site prior to calibration for optimum results. The manufacturer also recommends that sensors be shielded from direct sunlight for this reason.

4. Enter the ambient air temperature at the transducer location. For optimum results, allow enough time (100 minutes) to ensure that the sensor is at equilibrium with the surrounding ambient temperature. Press **ACCEPT**.

5. Select the Liquid Depth method and enter the new level.

6. Take a physical measurement of the liquid depth (level) and enter the value.

7. Press **ACCEPT** when finished.

4.1.3.2 Sensor Height

This method requires you to enter the distance between the face of the ultrasonic sensor and the zero flow point in the primary device. The zero flow point in a primary device is the level at which flow ceases. In a round pipe the zero flow point would typically be the invert or bottom of the pipe. In a V-notch weir the zero flow point occurs when the liquid behind the weir is level with the bottom of the 'V'. (There would still be liquid behind the weir plate but it would not be contributing to flow). Sensor Height calibration is generally used when:

- Access to the primary device is difficult (confined space entry) or
- There is no liquid flowing during installation of the flow meter.

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>CALIBRATION>ULTRASONIC SENSOR.**

2. Select Calibrate U-Sonic using the **UP** and **DOWN** keys. Press **SELECT**.

3. Select Standard as the type of Ultrasonic Transducer using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

   The speed of sound in air varies with the temperature of the air. The ultrasonic sensor is equipped with temperature compensation to help eliminate the effect of temperature variation under normal site conditions.

4. Enter the ambient air temperature at the transducer location. For optimum results, allow enough time (100 minutes) to ensure that the sensor is at equilibrium with the surrounding ambient temperature. Press **ACCEPT**.

5. Select the Sensor Height method and enter the new level.

6. Enter the distance from the face of the transducer to the zero flow point of the primary device.

7. Press **ACCEPT** when finished.

4.1.3.3 Setting the Invisible Range

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>CALIBRATION>ULTRASONIC SENSOR.**

2. Select the Invisible Range option using the **UP** and **DOWN** keys. Press **SELECT** to continue.

3. Enter the Distance to End of the Invisible Range.

4. Select either inches or centimeters using the **CHANGE UNITS** key. The distance must be greater than the minimum deadband of 10 in. (25.4 cm) for the 75 kHz sensor and 15 in. (38.1 cm) for the 50 kHz sensor.

5. Press **ACCEPT** when finished.

4.2 Submerged Area/Velocity Sensor

Submerged Area/Velocity Sensor utilizes a pressure transducer in conjunction with the Doppler method of velocity measurement to calculate flow in open channels. A small sensor containing both a transducer and velocity sensor is affixed in the flow stream. The instrument reads the pressure of the water and converts it to a level reading. The instrument then calculates the 'wetted area' of the flow stream utilizing the user centered channel shape. Once the wetted area and the velocity are known the following formula is used:
Area x Velocity = Flow.

4.2.1 Submerged Area/Velocity Sensor Connection

Table 7 Submerged/Area Velocity Sensor Connection

Pin	Signal Description	Wire Color
A	+12 V dc	Red
B	ground	Green
C	Receive (ground)	B/W Shield
D	Receive (+)	B/W Center
E	Transmit (ground)	Black Shield
F	Transmit (+)	Black Center
G	Depth (-)	Black
H	Depth (+)	White

Recommended Routing of Submerged Area/Velocity Cable
Proper routing of the cable serves two functions:

- Keeps the in-line desiccant assembly inside the cover and out of the way when installing and removing the sampler from tight manholes.

- Keeps the desiccant out of direct contact with the elements. Also, keeps water from dripping directly onto the desiccant assemble.

To secure the submerged area velocity cable, route the cable around the battery and clip it under the battery hold downs.

4.2.2 Submerged Area/Velocity Sensor Programming

1. From the Main Menu, select **OPTIONS>LEVEL SENSOR.**

2. Select Submerged Xducer using the **CHANGE CHOICE** key, then press **ACCEPT**.

3. From the **MAIN MENU**, select **SETUP>MODIFY SELECTED ITEMS.**

4. Highlight Velocity Direction using the **UP** and **DOWN** keys. Press **SELECT**.

5. Set the velocity direction (upstream, downstream, or always positive) using the **CHANGE CHOICE** key. Press **ACCEPT** to continue.

6. Highlight Velocity Units using the **UP** and **DOWN** keys. Press **SELECT**.

7. Set the Velocity Units (fps or m/s), using the **UP** and **DOWN** keys. Press **ACCEPT** to continue.

8. Highlight Velocity Cutoff, using the **UP** and **DOWN** keys. Press **SELECT**.

9. Read the Velocity Cutoff information screen. Press any key to continue.

10. Set the Velocity Cutoff using the numeric keypad. Press **ACCEPT**.

11. Set the Velocity Default, using the numeric keypad. Press **ACCEPT**. Press **RETURN** to go back to the Setup Menu or the **MAIN MENU** to return to the Main Menu display.

4.2.3 Submerged Area/Velocity Sensor Calibration

This calibration requires a graduated cylinder or bucket with at least 16 cm (6 in.) of water and a ruler. Calibrating the Submerged Area/Velocity Sensor characterizes the sampler electronics to the unique characteristics of each individual sensor. In addition, the calibration compensates for any sensor drift that may occur over time (6 months or greater) as the materials in the sensor age.

The Submerged Area/Velocity Sensor is a pressure transducer that contains a stainless steel diaphragm. As the water pressure increases, (with increasing level in the flow stream) the diaphragm is deflected, or pushed, against a solid state device called a strain gauge. The strain gauge converts the pressure against the diaphragm to a voltage. As the level in the flow stream increases, so does the voltage coming from the Submerged Area/Velocity Sensor. The voltage is read by the microprocessor in the sampler at regular intervals and converted to a number that represents the level in the flow stream.

It is recommended to calibrate the submerged area/velocity sensor when:

- The sensor is first used.
- Installing a new or different sensor on a flow meter or input receptacle.
- The difference between the level reading of the flow meter and the independent verification (measurement with a dipstick or ruler) is increasing.

Note: *The data is constant if the difference between the level reading of the flow meter and the independent verification is constant; recalibration is not required.*

Note: *Errors can occur with the flow meter level reading and the independent verification. Errors are caused by variation in site conditions and measurement abilities. These errors may cause slight changes in the difference, therefore, not indicating a true change in the difference.*

1. From the Main Menu, select **OPTIONS > ADVANCED OPTIONS > CALIBRATION > SUBMERGED PROBE.**

2. Place the sensor flat on a table top or floor with the sensor (the plate with holes) facing down onto the surface (Figure 18).

3. Press any key to continue.

4. Place the sensor face up in the bucket or liquid. Tap lightly to remove air bubbles. If these bubbles are not removed you can receive false readings from the sensor during calibration (Figure 18).

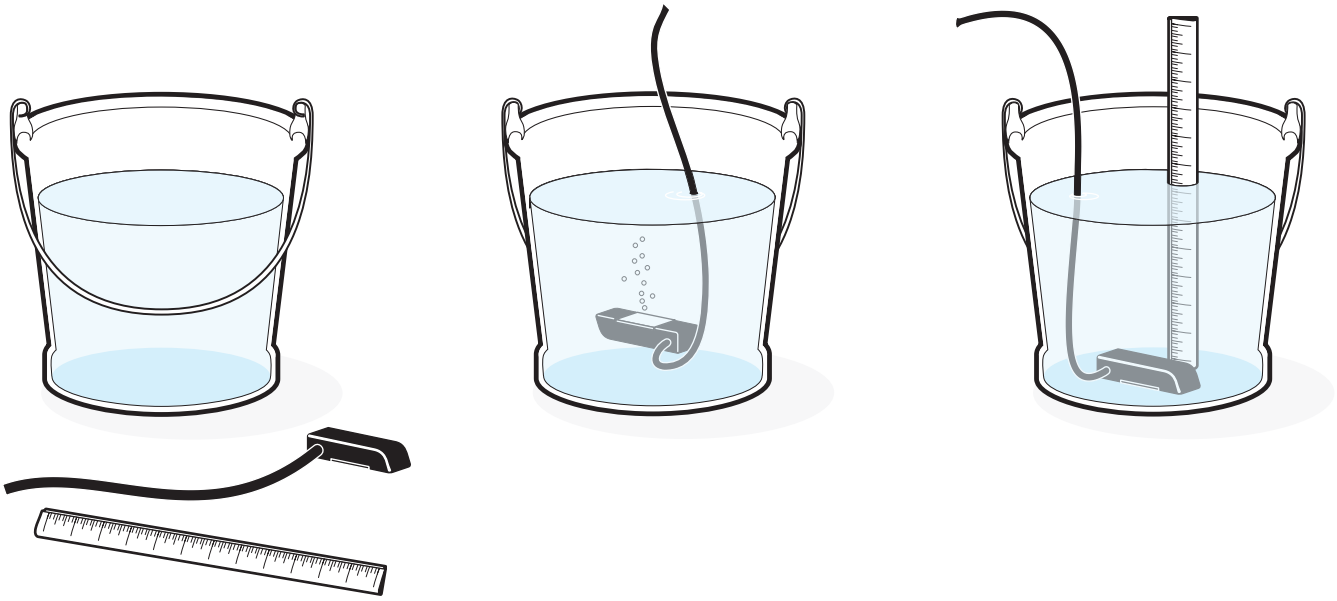
5. Place the sensor face down under at least 16 cm (6 in.) of water and wait 20 seconds. Make sure the water surface is calm and the sensor is stable. Press any key to continue.

Note: *Always check the Level Adjust when reinstalling the sampler following a calibration. (See Keypad Description on page 17.)*

6. Measure the depth from the bottom of the bucket to the surface of the water and enter the value using the numeric keypad (Figure 18).

7. Press **ACCEPT**.

Figure 18 Calibrating the Submerged Area/Velocity Sensor



4.3 Submerged Pressure Sensor

The submerged pressure sensor contains a submerged pressure transducer that measures level in an open channel flow stream.

The submerged pressure sensor is mounted in the flow stream at the proper location for level measurement. As the level in the channel increases and decreases, the pressure at the submerged sensor varies proportionately. The pressure transducer converts the water pressure to a voltage. The sampler uses the voltage to calculate the liquid level in the channel. After calculating the level, the sampler then converts the level reading to a flow rate based on the user-defined characteristics of the installed primary device.

The transducer in the submerged sensor first reads the pressure in the channel, then at regular intervals, switches to a reference port to compare it to the atmospheric pressure. This pressure difference is converted to a number which represents the liquid level. At regular intervals, both the pressure transducer diaphragm and the reference port are switched to atmosphere together. Then they are electronically zeroed to eliminate any drift due to changing barometric pressure.

4.3.1 Submerged Pressure Sensor Connection

The submerged pressure sensor connection is located on the left side of the controller housing and is labeled submerged pressure sensor. The connector is keyed and can only be inserted in the proper orientation (key up).

Table 8 Submerged Level Sensor Base Board Connection (J-21)

Pin	Signal Description	Wire Color
A	V +	Red
B	Out +	Yellow
C	Out -	Green
D	Ground	Black

4.3.2 Submerged Pressure Sensor Programming

1. From the Main Menu, select **OPTIONS>LEVEL SENSOR.**
2. Select Submerged Xducer using the **CHANGE CHOICE** key and press **ACCEPT**.

4.3.3 Submerged Pressure Sensor Calibration

To ensure optimum accuracy, calibrate the sampler approximately twice per year or when changing to a different submerged pressure sensor.

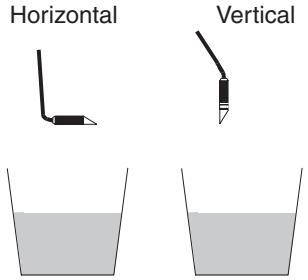
In sites where harsh conditions (extremes of level, temperature, harsh chemicals, etc.) calibration should be performed more often.

1. From the Main Menu, select **OPTIONS > ADVANCED OPTIONS > CALIBRATION > SUBMERGED PROBE.**
2. Choose the orientation that the sensor will be mounted in the flow stream, horizontal or vertical, using the **CHANGE CHOICE** key. Press **ACCEPT**.

11:00 AM 21 - APR - 01		CALIBRATION
ACCEPT	ORIENTATION OF SUBMERGED PROBE: HORIZONTAL	CHANGE CHOICE
CANCEL		
	SELECT APPROPRIATE UNITS	

3. Lift the sensor out of the water and hold it in the air in the same orientation selected (horizontal or vertical) (Figure 19). Then press **ACCEPT**.

Figure 19 Lifting the Sensor Out of the Water



4. Follow either the vertical or horizontal procedure below.

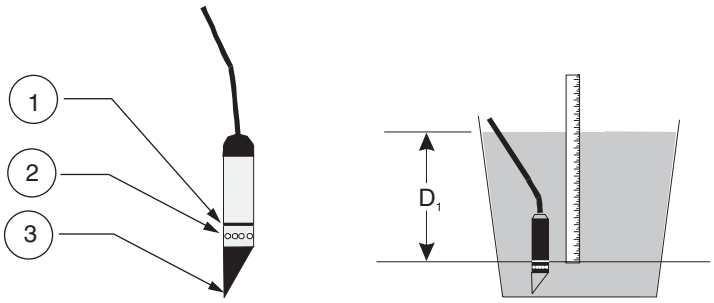
Vertical Orientation Only

a. Place the sensor under at least 16 cm (6 in.) of water in a vertical orientation. Make sure the sensor is stable and not moving around. Then press **ACCEPT** to continue.

b. Carefully measure the depth (D_1) from the surface of the water to the first weld mark that encircles the sensor body just above the breather vent holes (Figure 20). The weld mark indicates the location of the internal diaphragm.

c. Enter the depth (D_1) using the numeric keypad then press **ACCEPT**.

Figure 20 Measuring Submerged Depth, Vertical Orientation



1. Gray Band	**2.** Breather Vents	**3.** Detachable Nose Cone

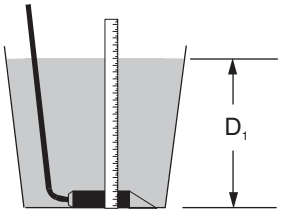
Horizontal Orientation Only

Note: *Always check the Level Adjust when reinstalling the sampler following a calibration.*

a. Place the sensor under at least 16 cm (6 in.) of water in a horizontal orientation. Make sure the sensor is stable and not moving around. Then press **ACCEPT** to continue.

b. Measure the depth from the bottom of the bucket to the surface of the water (D_1) (Figure 21) and enter the value. Press **ACCEPT**.

Figure 21 Measuring Submerged Depth, Horizontal Orientation



4.4 Thermal Sensor

The sampler utilizes a unique refrigeration compartment thermal sensor which is encased in a thermal mass (the thermal mass is located in the back right corner of the refrigerator compartment). This mass is designed to simulate the thermal characteristics of a typical liquid sample. When the refrigerator door is opened, warm air rushes in and displaces some of the cool air. When the door is shut, the refrigerator cools the interior air back to 4 °C again.

The temperature of the sample is not affected as quickly as the temperature of the air. It takes time for a volume of water to change temperature. Since it is the sample we wish to keep at 4 °C and not the air, the sampler thermal sensor accurately simulates the sample so the controller can maintain the sample temperature exactly. Typical air sensing thermostats fight to maintain air temperature, not sample temperature and so are not as accurate or efficient at preserving samples.

4.4.1 Thermal Sensor Programming

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>CALIBRATION> THERMAL SETUP.**

2. Enter the refrigeration compartment temperature in degrees centigrade from 2–10 °C. Typical sample preservation temperature is 4 °C.

4.4.2 Thermal Sensor Calibration

1. To verify the accuracy of the refrigerator compartment temperature which is indicated on the sampler controller display, place a laboratory grade thermometer into a beaker with 150 mL water into the right rear corner of the refrigerated compartment, and then close the refrigerator compartment door.

2. Allow the refrigerator to run for 2–3 hours. This will ensure equilibrium between the temperature in the compartment and the water in the beaker.

3. Compare the temperature readout on the Status display (press **STATUS**) with the temperature indicated on the thermometer. If the readings do not agree, it is necessary to calibrate the Reference Temperature Sensor. This cylindrical shaped sensor is located in the refrigerated compartment right rear corner, and is held in place by a clip bracket.

4. Shut off the sampler controller by pressing the **OFF** button.

5. Prepare an ice bath in a 500 mL beaker, using a 50/50 mix of crushed ice and water.

6. Remove the Reference Temperature Sensor (RTS) from the bracket, and place the beaker next to the bracket.

7. Place the sensor and the lab grade thermometer in the beaker/ice bath.

8. With the sampler controller off and the door closed, wait approximately 30 minutes for the reference sensor and lab thermometer to stabilize within the ice bath temperature. After waiting 30 minutes, mix (swirl) ice bath.

9. Turn on the controller by pressing the **ON** button.

10. From the Main Menu, select **OPTIONS> ADVANCED OPTIONS> THERMAL SETUP>THERMAL CALIBRATE.**

11. In °C, enter the reading indicated on the thermometer in the Ice bath, to the nearest one tenth degree. Press **ACCEPT** to continue. This completes the calibration procedure.

12. Reinstall the RTS.

This section describes how to setup a rain gauge to the Sampler as well as how to connect, program, and calibrate the optional water quality probes:

- Rain Gauge (section 5.1 on page 65)
- pH Probe (section 5.2 on page 66)
- ORP Probe (section 5.3 on page 68)
- Dissolved Oxygen Probe (section 5.4 on page 70)
- Conductivity Probe (section 5.5 on page 72)

5.1 Rain Gauge

An external “tipping bucket” rain gauge (Cat. No. 2149) can be connected to the Rain Gauge connector of the sampler (Figure 22). The rain gauge provides a dry contact closure to the sampler.

As rainfall collects in the 20 cm (8 in.) diameter funnel, it is directed into one side of a “tipping bucket” assembly. As each bucket fills, it causes the bucket assembly to tip and empty out into the bottom of the rain gauge. Each tip of the bucket causes a single contact closure to the rain gauge and sends a short 12 V dc pulse into pin C of the Rain Gauge connector. Each pulse (tip) represents 0.025 cm (0.01 in.) of rain.

Figure 22 Rain Gauge Tipping Bucket

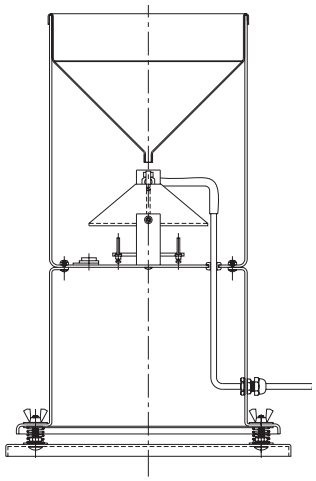


Table 9 Rain Gauge Base Board Connections (J-5)

Pin	Signal Description
A	+12 V dc source output
B	not used
C	+12 V dc pulse input
D	not used
E	not used
F	not used

5.1.1 Rain Gauge Programming

Note: If logging is enabled on any channel, then that channel will have an arrow in front of the channel name that signifies that the channel is logged.

1. From the Main Menu select **OPTIONS>ADVANCED OPTIONS>DATALOG.**
2. Highlight Select Inputs using the **UP** and **DOWN** keys and press **SELECT**.
3. Highlight Rainfall using the **UP** and **DOWN** keys, then press **SELECT**.
4. Press **CHANGE CHOICE** to cycle between Logged and Not Logged, then press **ACCEPT**.
5. Enter a logging interval, then press **ACCEPT**. Valid logging intervals are shown on the status bar along the bottom edge of the display.
6. Select Rainfall Units (in. or cm).
7. Select another channel to configure, or press **RETURN** to back up one step or press **MAIN MENU** to return to the Main Menu.

5.2 pH Probe

The pH probes are shipped with a wetting cap that covers the probe tip. Remove the cap by turning it counter-clockwise and gently easing it off. Keep this cap for long-term probe storage. Rinse the probe tip with distilled water.

Store the probe in a pH 4.0 buffer (Cat. No. 2104) for both overnight and long term storage. Never store a probe in distilled or deionized water because this will deplete the probe filling solution.

5.2.1 pH Probe Connection

This connector is for installing the pH or ORP pre-amp interface junction box or a stand-alone temperature sensor. The pH probe is attached to a terminal strip in the junction box. The stand-alone temperature probe plugs directly into the receptacle on the case.

The pre-amplifier junction box is provided to allow for fast, easy replacement of the pH probe.

Table 10 pH Connector Pin Assignments (J-3)

Pin	Signal Description	Wire Color
A	+5 V dc	White
B	ground	Blue
C	reference	Yellow
D	pH/ORP	Black
E	-5 V dc	Red
F	RTD	Green

Figure 23 shows the wiring of the pH probe in the pre-amplifier junction box. Since the pH reading needs to compensate for temperature variation, a temperature sensor is built into every pH electrode. The pH probe consists of five wires, three for the pH probe and two for the temperature sensor.

Stray electrical currents are sometimes found in wastewater stream. These stray electrical currents can affect the pH readings. In the case of stray electrical currents, a grounded pH probe is required (Figure 24).

Figure 23 pH Probe Wiring to Junction Box (grounded)

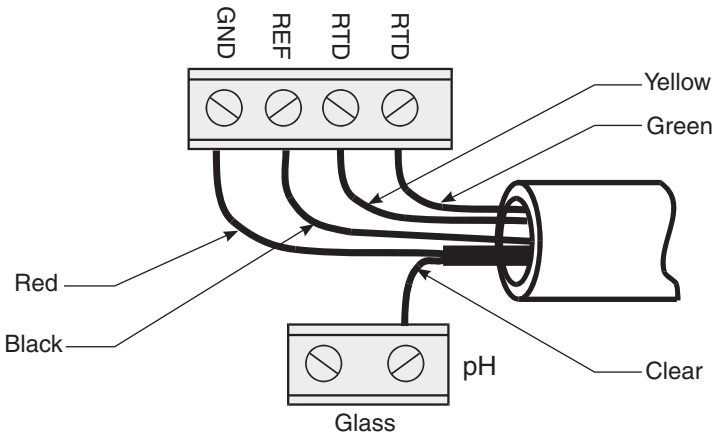
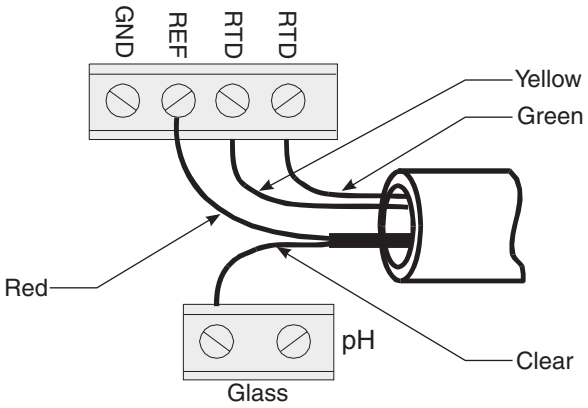


Figure 24 pH Probe Wiring to Junction Box (un-grounded)



5.2.2 pH Probe Programming

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>DATALOG.**
2. Highlight Select Inputs using the **UP** and **DOWN** keys and press **SELECT**.
3. Highlight pH using the **UP** and **DOWN** keys, then press **SELECT**.
4. Press **CHANGE CHOICE** to cycle between Logged and Not Logged, then press **ACCEPT**.
5. Enter a logging interval, then press **ACCEPT**. Valid logging intervals are shown on the status bar along the bottom edge of the display.
6. Select another channel to configure or press **RETURN** to back up one step or press **MAIN MENU** to return to the Main Menu display.

5.2.3 pH Probe Calibration

Calibrate the pH probe after the pH probe is connected and programmed. Calibrating the pH probe requires a thermometer and any two of the following buffer solutions: 4, 7, or 10 pH.

The pH probe is an application sensitive device. When used in harsh environments, the accuracy and life expectancy of pH probes can decrease considerably. Probes must be calibrated to the sampler each time they are cleaned or replaced. Regular inspection and comparison to a hand-held pH meter can help determine the optimum cleaning and calibration schedule for specific applications.

1. From the Main Menu, select **OPTIONS > ADVANCED OPTIONS > CALIBRATION > PH.**

2. Place the pH probe into the first buffer solution, then press any key to continue.

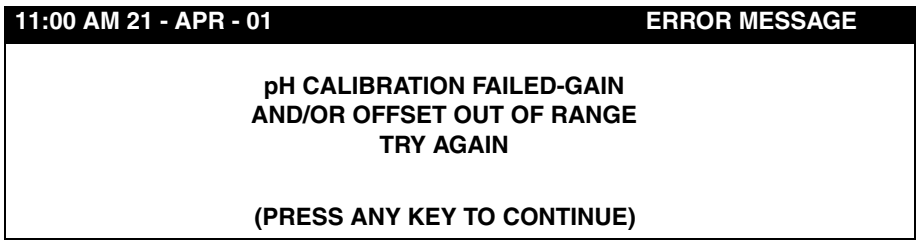
3. Enter the temperature of the first buffer solution using the numeric keypad. Press **ACCEPT** to continue.

4. Select the pH for the first buffer solution (4, 7, or 10 pH) using the **CHANGE CHOICE** key, then press **ACCEPT** to continue.

5. Remove the probe from the first buffer solution, rinse it under distilled water and place it into the second buffer solution (4, 7, or 10 pH, different from the first buffer used). Press any key to continue.

6. Select the pH for the second buffer solution using the **CHANGE CHOICE** key, then press **ACCEPT** to continue.

   If the pH probe is damaged and cannot be calibrated or if the buffer solutions do not fall within an acceptable range, an error message will be displayed as shown below.



   Another attempt at reading the second buffer solution will be made after pressing a key. If this fails, it is likely that you have a bad pH probe or bad buffer solutions. Try a new set of buffer solutions and if that fails try a different pH probe.

5.3 ORP Probe

The probes are shipped with a wetting cap that covers the probe tip. Remove the cap by turning it counter-clockwise and gently easing it off. Keep this cap for long-term probe storage. Rinse the probe tip with distilled water.

Store the probe in a pH 4.0 buffer (Cat. No. 22834-49) for both overnight and long term storage. Never store a probe in distilled or deionized water because this will deplete the probe filling solution.

5.3.1 ORP Probe Connection

This connector is for installing the pH or ORP pre-amp interface junction box or a stand-alone temperature sensor. The ORP probe is attached to a terminal strip in the junction box.

Table 11 ORP Connector Pin Assignments (J3)

Pin	Signal Description	Wire Color
A	+5 V dc	White
B	ground	Blue
C	reference	Yellow
D	pH/ORP	Black
E	-5 V dc	Red
F	RTD	Green

The ORP probe consists of three wires; a pink, black, and red wire. There is no temperature sensor on the ORP probe.

1. Attach the clear wire to either screw on the terminal strip labeled GLASS.
2. Attach the black wire to the REF screw on the other terminal strip.
3. Attach the red wire to the GND screw on the terminal strip.

5.3.2 ORP Probe Programming

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>DATALOG.**
2. Highlight Select Inputs using the **UP** and **DOWN** keys and press **SELECT**.
3. Highlight ORP using the **UP** and **DOWN** keys, then press **SELECT**.
4. Press **CHANGE CHOICE** to cycle between Logged and Not Logged, then press **ACCEPT** to continue.
5. Enter a logging interval using the numeric keypad, then press **ACCEPT**. Valid logging intervals are shown on the status bar along the bottom edge of the display.
6. Select another channel to configure or press **RETURN** to back up one step or press **MAIN MENU** to return to the Main Menu.

5.3.3 ORP Probe Calibration

5.3.3.1 ORP Preamplifier/Junction Box Calibration

Calibration of the ORP input circuit requires a source of dc voltage between 500 and 2000 mV dc. The reference voltage must be applied to the ORP input terminals on the preamplifier/junction box during calibration. A regulated dc power supply or a standard “C” cell battery (1500 mV dc) make excellent sources for reference voltage.

1. From the Main Menu, select **OPTIONS > ADVANCED OPTIONS > CALIBRATION > ORP.**

2. Install the ORP junction box on the sampler with the ORP probe removed.

3. Apply a positive reference voltage to the ORP probe terminals in the junction box, using either a 1.5 V dc “C” cell battery or a regulated power supply.

4. Attach the positive battery terminal to the terminal block screw labeled “glass” and the negative battery terminal to the terminal block screw labeled “ref.”

5. After making all connections, measure the exact voltage on the “C” cell or power supply with a voltmeter. Then press a key to continue. The sampler displays the message “Waiting for ORP to Stabilize.”

6. Once the reading is sufficiently stable enter a new millivolt level. The “C” cell battery should be approximately 1500 mV (or 1.5 V) when new. Enter the exact voltage of the current source in millivolts.

7. Press **ACCEPT** to store the new calibration values.

8. Disconnect the “C” cell battery or regulated power supply from the ORP input terminals.

9. Reconnect the ORP Probe leads to the input terminals.

5.4 Dissolved Oxygen Probe

5.4.1 Dissolved Oxygen Probe Connection

This connection is for interfacing the optional D.O. probe to the D.O./Conductivity Pre-Amp (Cat. No. 3369).

Table 12 D.O. Connections (J-20)

Pin	Signal Description	Wire Color
A	DO - (neg)	Green
B	DO + (pos)	Red
C	Thermister	Black
D	Thermister	Yellow

Strain Relief Recommendation
It is recommended that a strain relief be used to protect the cable/probe junction during application where the sensor will be thrown or tossed into liquid.

5.4.2 Dissolved Oxygen Probe Programming

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>DATALOG.**

2. Highlight Select Inputs using the **UP** and **DOWN** keys, then press **SELECT**.

3. Highlight D.O. using the **UP** and **DOWN** keys, then press the **SELECT**.

4. Press **CHANGE CHOICE** to cycle between Logged and Not Logged, then press **ACCEPT**.

5. Enter a logging interval, then press **ACCEPT**. Valid logging intervals are shown on the status bar.

6. Press **CHANGE CHOICE** to select the appropriate units (ppm, ppb, mg/L, sat). Press **ACCEPT** to continue.

7. Select another channel to configure or press **RETURN** to back up one step or press **MAIN MENU** to return to the Main Menu.

5.4.3 Dissolved Oxygen Probe Temperature Programming

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>DATALOG**

2. Highlight Select Inputs using the **UP** and **DOWN** keys, then press **SELECT**.

3. Highlight D.O. Temp. using the **UP** and **DOWN** keys, then press **SELECT**.

4. Press **CHANGE CHOICE** to cycle between Logged and Not Logged, then press **ACCEPT**.

5. Enter a logging interval, then press **ACCEPT**. Valid logging intervals are shown on the status bar along the bottom edge of the display.

6. Press **CHANGE CHOICE** to select the temperature units (°C, °F). Press **ACCEPT**.

5.4.4 Dissolved Oxygen Probe Calibration

1. Connect a suitable power supply to the sampler.

2. Power up the unit by pressing the **ON** button.

3. From the Main Menu, select **OPTIONS > ADVANCED OPTIONS > CALIBRATION > DO.**

4. Enter the ambient air temperature (the current reading is displayed for reference) using the numeric keypad.

5. Enter the elevation above sea level for the specific location.

6. Enter the membrane thickness. The operation of the sampler will be affected by the choice of membrane thickness for the oxygen sensor.

For general purpose applications, the 1 Mil thick membrane is standard. This membrane allows measurements in the 0 to 20 ppm range of dissolved oxygen and provides the best general purpose trade-off between response time and durability.

The 2 Mil thick membrane can be used to measure up to 40 ppm dissolved oxygen. Its increased thickness slows the response time of the sensor, but this membrane has increased resistance to cuts and tears. For this reason, it is recommended for use in wastewater aeration basins where solids in the water are in rapid motion.

7. Enter the chlorinity (salinity) of the flow stream (typical wastewater is zero, sea water is higher).

8. Place the D.O. probe in open air and press any key. The sampler will wait for the reading to stabilize before storing the calibration value. The screen will automatically return to the calibration menu.

Note: *The membrane of a charged sensor must be kept moist. If the membrane is allowed to dry completely, the electrolyte film between the membrane and the platinum will evaporate, destabilizing the sensor. If the sensor will be out of water for more than 30 minutes, put a small amount of water in the silicon soaking cap, and install it over the protective guard. Lift the edge of the cap to break the seal as it is being removed. This will prevent a vacuum from forming inside the soaking cap while it is being removed which can result in the membrane becoming stretched.*

Calibrating the D.O. Temperature

1. Place the probe and the thermometer in a liquid.
2. Wait for the temperature reading to stabilize.
3. Enter the actual temperature of the liquid.

5.5 Conductivity Probe

5.5.1 Conductivity Probe Connection

Table 13 Conductivity Probe Wiring (J-20)

Pin	Signal Description	Wire Color
A	Probe	Black
B	Probe	Red
C	RTD	White
D	RTD	Green

5.5.2 Conductivity Probe Programming

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>DATALOG.**
2. Highlight Select Inputs using the **UP** and **DOWN** keys, then press **SELECT**.
3. Highlight Conductivity (COND.) using the **UP** and **DOWN** keys, then press **SELECT**.
4. Press **CHANGE CHOICE** to cycle between Logged and Not Logged, then press **ACCEPT**.
5. Enter a logging interval, then press **ACCEPT**. Valid logging intervals are shown on the status bar along the bottom edge of the display.
6. Press **CHANGE CHOICE** to select the appropriate units (ms, μs). Press **ACCEPT** to continue.
7. Select another channel to configure or press **RETURN** to back up one step or press **MAIN MENU** to return to the Main Menu display.

5.5.3 Conductivity Temperature Programming

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>DATALOG.**
2. Highlight Select Inputs using the **UP** and **DOWN** keys, then press **SELECT**.
3. Highlight Conductivity Temperature (COND. TEMP.) using the **UP** and **DOWN** keys, then press **SELECT**.
4. Press **CHANGE CHOICE** to cycle between Logged and Not Logged, then press **ACCEPT**.
5. Enter a logging interval, then press **ACCEPT**. Valid logging intervals are shown on the status bar along the bottom edge of the display.
6. Press **CHANGE CHOICE** to select temperature units (°C, °F). Press **ACCEPT**.

5.5.4 Conductivity Probe Calibration

1. From the Main Menu, select **OPTIONS > ADVANCED OPTIONS > CALIBRATION > CONDUCTIVITY.**
2. Clean and dry the probe.
3. Place the sensor and thermometer in the calibration solution (Cat. No. 3230).
4. Allow the sensor to stabilize in the solution about 10 minutes to ensure that the probe and the solution are the same temperature.
5. Enter the temperature correction factor or enter zero (0) for no correction factor.

Note: *The temperature correction factor is used to compensate for the effects of temperature on the conductivity readings at the point of installation. The conductivity of a solution is temperature sensitive. Therefore the actual conductivity of the solution will change with the temperature. Each site may have a different correction factor depending on the major constituent of the flow stream. This is not used for calibration and has no effect on the calibration of the sensor. Below are some examples of compensation factors of various liquids.*

- *0.96%/°C 5% Sulfuric Acid*
- *1.88%/°C Dilute Ammonia*
- *1.91%/°C 'Typical' Wastewater*
- *1.97%/°C Potassium Chloride*
- *2.12%/°C Salt (Sodium Chloride)*
- *2.84%/°C 98% Sulfuric Acid*
- *4.55%/°C Ultra-pure Water*

6. With the sensor still in the calibration solution, press any key. Wait for the sensor to stabilize. Calculate the actual conductivity of the calibration solution. If using the KCl solution provided by the manufacturer, make your selection from the calibration (refer to Table 14 on page 75). If using a solution other than 1.0 mS @ 25 °C KCl available from the manufacturer, you must calculate the conductivity of the solution using temperature correction factors. See the following example.

   Example:

   The KCl calibration solution is 1.0 mS. at 25°C. The temperature correction factor for KCl is 1.97%/°C. If the actual temperature of the KCl at the time of calibration is 18.4 °C, then the solution has a conductivity value of 0.870 mS.

   a. Find the difference between the labeled temperature and the actual temperature of the calibration solution at the time of calibration.

   25 °C – 18.4 °C = 6.6 °C

   b. Multiply the difference (6.6) by the correction factor per °C (1.97% or 0.0197).

   6.6 °C x 0.0197/°C = 0.13002

   c. If the calibration temperature is lower than the labeled value, then subtract that value from the standard (1.0 mS) to get the actual value to be used for calibration.

   1.0 mS - (correction factor) 0.13002 = 0.86998 mS

   d. If the calibration temperature is higher than the labeled value, then add that value to the standard (1.0 mS) to get the actual value to be used for calibration.

7. Using the value that was calculated in step 6, enter the conductivity of the solution then press **ACCEPT**.

Calibrating the Conductivity Temperature
Necessary when logging temperature only.

1. Place the probe in a liquid. Wait for the temperature reading to stabilize.

2. Enter the actual temperature of the liquid (the current reading is shown for reference). Temperature calibration is complete.

Table 14 Conductivity Values at Temperature for KCl Solution

Solution Temp °C	Calibration Value to be Entered	Solution Temp °C	Calibration Value to be Entered	Solution Temp °C	Calibration Value to be Entered
30	1.099	25	1.000	20	0.902
29.8	1.095	24.8	0.996	19.8	0.898
29.6	1.091	24.6	0.992	19.6	0.894
29.4	1.087	24.4	0.988	19.4	0.890
29.2	1.083	24.2	0.984	19.2	0.886
29	1.079	24	0.980	19	0.882
28.8	1.075	23.8	0.976	18.8	0.878
28.6	1.071	23.6	0.972	18.6	0.874
28.4	1.067	23.4	0.968	18.4	0.870
28.2	1.063	23.2	0.965	18.2	0.866
28	1.059	23	0.961	18	0.862
27.8	1.055	22.8	0.957	17.8	0.858
27.6	1.051	22.6	0.953	17.6	0.854
27.4	1.047	22.4	0.949	17.4	0.850
27.2	1.043	22.2	0.945	17.2	0.846
27	1.039	22	0.941	17	0.842
26.8	1.035	21.8	0.937	16.8	0.838
26.6	1.032	21.6	0.933	16.6	0.835
26.4	1.028	21.4	0.929	16.4	0.831
26.2	1.024	21.2	0.925	16.2	0.827
26	1.020	21	0.921	16	0.823
25.8	1.016	20.8	0.917	15.8	0.819
25.6	1.012	20.6	0.913	15.6	0.815
25.4	1.008	20.4	0.909	15.4	0.811
25.2	1.004	20.2	0.905	15.2	0.807

Communication setup details connections and programming features of the:

- RS232 Serial Port (section 6.1 on page 77)
- Optional Modem (section 6.2 on page 78)
- 4–20 mA Interface (section 6.3 on page 85)
- Alarm Relays (section 6.4 on page 87)
- Analog Inputs (section 6.5 on page 91)

6.1 RS232 Cable

6.1.1 RS232 Connection

The RS232 connector is a serial input/output port for communicating with a sampler from an external device such as a Data Transfer Unit (DTU-II) or direct serial connection to a personal computer running InSight® Software.

This port can be configured to communicate at 1200, 2400, 4800, 9600, or 19,200 baud.

Table 15 RS232 Connection

Pin	Signal Description	Wire Color
A	not used	White
B	ground	Blue
C	DSR	Yellow
D	RCD	Black
E	DTR	Red
F	TXD	Green

Cable Required
RS232 Sampler/Flow Meter to PC Cable Assembly (Cat. No. 1727), 10’ long, 6-pin connector on one end, 9-pin D connector on the other end (9-pin to 25-pin D type adapter included).

6.1.2 RS232 Programming

Note: *Some early generation IBM compatibles may have a serial port that is not capable of communicating reliable at 19,200 baud. If errors develop at high baud rates, try lowering the baud rate one step at a time (on both the sampler and Streamlogg II™, InSight®, or Vision® software) until error free communications is achieved.*

1. From the Main Menu, select **OPTIONS > ADVANCED OPTIONS > COMMUNICATIONS SETUP > RS232 SETUP**.

2. Select a baud rate for data communications by pressing **CHANGE CHOICE** to cycle through the possible choices; 1200, 2400, 4800, 9600 or 19,200 baud. The higher the baud rate setting, the faster data will transfer. Set the baud rate to the highest setting allowed by the computer. The baud rate must correspond to the baud rate selected in the software. Press **ACCEPT**.

Note: *Long runs of RS232 cable, especially if they are run near large motors or fluorescent lights can cause communication errors and may require a slower baud rate.*

6.2 Modem

6.2.1 Modem Connection

This connection is for interfacing the optional internal modem (Cat. No. 1602) with a standard public telephone line.

Table 16 Modem CPU Connections (J-8)

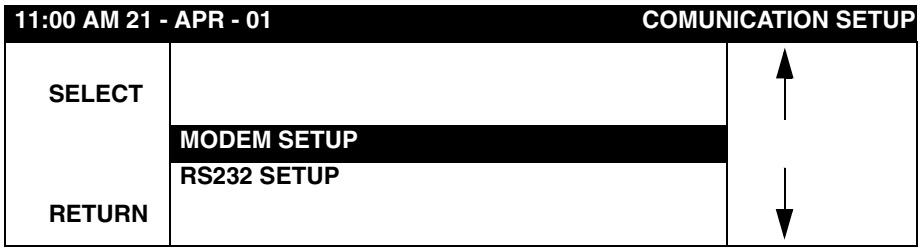
Pin	Signal Description
A	Tip
B	Ring
C	12 V dc
D	12 V dc Reference

6.2.2 Modem Programming

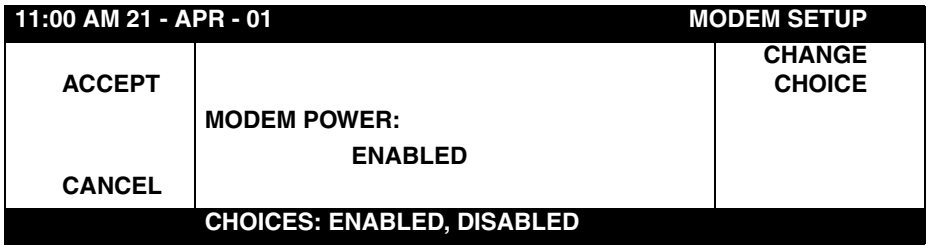
1. From the Main Menu, select **OPTIONS>ADVANCED OPTION>COMMUNICATIONS SETUP**.

Note: *There is no way of independently enabling power to just the internal modem without also enabling the power to the Cellular Communications Option if it is present. However, this poses no problem even if the sampler is physically connected directly to a phone line without a cellular phone.*

2. Highlight Modem Setup using the **UP** and **DOWN** keys. Press **ACCEPT**.



3. Enable modem power by pressing **CHANGE CHOICE**. Modem power is turned off when not in use to conserve battery power.



4. Select pulse or tone dialing modes. This will depend on the type of phone service selected for the site phone line. Press **ACCEPT**.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	DIAL METHOD: TONE	CHANGE CHOICE
CANCEL		
	CHOICES: TONE, PULSE	

5. Enter a phone number using the numeric keypad. This phone number is used by the modem when it sends an alarm report to a personal computer running InSight® software.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	INPUT CHANNEL: FLOW	CHANGE CHOICE
CANCEL		
	(USE NUMERIC KEYPAD)	

6.2.2.1 Cellular Communication Option

Note: *To ensure reliable communications between the sampler and the host computer, it is required that the host computer is equipped with a Cellular Compatible modem, it must support the MNP.10EC protocol. Computers equipped with modems that do not support this protocol are able to connect to the sampler but will not be able to maintain a reliable connection.*

This option couples the sampler to an external, 3-watt, cellular phone. The cellular phone is mounted in a NEMA 4X enclosure and is powered through the sampler by the sampler power supply. Enabling Modem Power also provides power to the Cellular Communication via a connector cable.

The cellular phone is set to activate upon an alarm. Additionally, the end user can use the phone to make cellular voice calls directly from the installation site as needed.

Site Selection

The quality and availability of cellular service varies considerably from one geographical location and from day to day. Factors that affect the quality of cellular service include but are not limited to: weather, time of day, distance to the nearest cell tower, other cellular traffic, etc.

Installation and Setup

Note: *Mount the antenna as high and as far away from the sampler as possible. RF power radiated during transmission by the cell phone antenna in close proximity to the sampler may have adverse affects on data measurements.*

1. Connect the four conductor cable between the four pin connector on the side of the cellular phone housing and to the connector in the side of the sampler case labeled MODEM. This cable supplies both the data and the 12 V dc power for the cell modem.

Note: *If the display on the cell phone is not present, check to make sure the cell phone power is enabled in the setup of the sampler. Also check to make sure that the sampler is connected to a power source and is turned on.*

2. Attach the magnetic base cell phone antenna to any flat metal object in the immediate area. For optimum performance, mount the antenna in a vertical position.

3. When necessary, reposition the antenna to obtain optimum signal strength.

4. Loosen the four screws on the cover of the cell phone enclosure and remove the cover, to view the signal strength. The signal strength is indicated by the number of dashes across the bottom of the cell phone display. The more dashes across the bottom of the display the greater the signal.

6.2.2.2 Reliable Communications

In order to ensure reliable communications between the sampler and the host computer, it is absolutely essential that the host computer is equipped with a Cellular Compatible modem. The modem on the host computer must support the “MNP.10ED” protocol. Computers equipped with modems that do not support this protocol may be able to connect to the sampler but will not be able to maintain reliable connections.

6.2.2.3 Cellular Modem Scheduling

With Cellular Modem Scheduling enabled, both the modem and cell phone power will simultaneously be turned off and on at user defined intervals to conserve battery power. If Cellular Modem Scheduling is disabled the sampler will assume that a land line is available and that the cell phone is not connected to the sampler. With Cellular Modem Scheduling disabled (and the sampler on battery power) the sampler will leave the modem turned off until a call is received on the land line.

Note: *If the Cellular Modem Scheduling is disabled and the sampler is connected to a cell phone rather than a land line, the sampler will not be able to answer any incoming calls.*

If the sampler is on ac power or the battery voltage is over 14.5 volts, the power to both the cell phone and modem will constantly be on regardless of whether Cellular Modem Scheduling is enabled or not.

If the sampler is configured to call a pager for alarms and the alarm condition is met, the sampler will still call the pager even if modem scheduling is disabled. In this situation the cell phone and modem will temporally be powered back up again to allow the sampler to call the pager and transmit the alarm code. However, as soon as the alarm code is transmitted, the power to the cell phone and modem will again be turned off.

1. To enable Cellular Modem Scheduling, Modem Power must be enabled.

Note: *If Modem Power is not enabled the prompts for Cellular Modem Scheduling will not appear.*

2. Enable the Cellular Modem Scheduling using the **CHANGE CHOICE** key.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	CELLULAR MODEM SCHEDULING: ENABLED	CHANGE CHOICE
CANCEL		
	CHOICES: ENABLED, DISABLED	

3. Press **ACCEPT** to continue.

6.2.2.4 Cellular Modem Scheduling Basis

After enabling Cellular Modem Scheduling it will be necessary to choose the type of scheduling; Hourly, Daily or Weekly. If Hourly is chosen the modem and cell phone are powered up once every hour on the hour for a user defined duration. If Daily is chosen the modem and cell phone are powered up once a day, every day, at a user defined time and duration. If Weekly is chosen the cell phone and modem are powered up only once a week, every week, on a user defined day, time, and duration.

1. To set the Cellular Modem Scheduling Basis press **CHANGE CHOICE** until the correct choice appears in the center of the display. Press **ACCEPT**.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	CELLULAR MODEM SCHEDULING BASIS: DAILY	CHANGE CHOICE
CANCEL		
	CHOICES: HOURLY, DAILY, WEEKLY	

2. Set up the actual time and duration when the modem will be enabled using the numeric keypad.

3. If Hourly, enter the duration time that the modem will be turned on.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	CELLULAR SCHEDULING DURATION: 5 min.	
CANCEL		CLEAR ENTRY
	ENTER: 1 - 59	

4. If Daily, enter the Cellular Scheduling Start Time and Duration.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	CELLULAR SCHEDULING START TIME: 1:00 (hrs:min)	CLEAR ENTRY
CANCEL		
	ENTER: 000:01 - 024:00 (hrs:min)	

5. If Weekly, enter the Cellular Modem Schedule Day, Start time, and Duration.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	CELLULAR MODEM SCHEDULE DAY: FLOW	CLEAR ENTRY
CANCEL		
	CHOICES: MON, TUE, WED, THU, FRI, SAT, SUN	

6.2.2.5 Cellular Modem Triggering

When Cellular Modem Triggering is enabled both the cell phone and modem remains on for a user specified duration after calling a pager or remote computer when an alarm condition is met. It is useful when calling back to a site via modem, after receiving an alarm, or viewing the current status.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	CELLULAR MODEM TRIGGERING:	
	ENABLED	CLEAR ENTRY
CANCEL		
	CHOICES: ENABLED, DISABLED	

Note: *This display will not appear unless Cellular Modem Scheduling is enabled.*

If Cellular Modem Triggering is disabled the sampler is still able to call a pager or remote computer when an alarm condition is met. However, both the modem and cell phone will immediately turn off after the call is completed.

Cellular Modem Triggered Duration

After enabling Cellular Modem Triggering, enter a value for Cellular Modem Triggered Duration. This is the amount of time that the modem remains on after it dials a pager or remote computer when an alarm condition has been met. The value is in minutes and can be anywhere between 1 to 120 minutes.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	CELLULAR MODEM TRIGGERING DURATION:	
	30 min.	CLEAR ENTRY
CANCEL		
	ENTER 1 - 120	

Note: *This display will not appear unless Cellular Modem Triggering is enabled.*

6.2.2.6 Pager Option

The sampler can be set up to call up to 3 individual pagers or a remote computer when an alarm condition has been met. The pager setup is an extension of the Modem Setup menus. To have the sampler call a pager, the Pager Option must be enabled.

1. Enable the Pager Option using the **CHANGE CHOICE** key until enabled is displayed. Press **ACCEPT**.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT		CHANGE CHOICE
	PAGER OPTION:	
	ENABLED	
CANCEL		
	CHOICES: ENABLED, DISABLED	

2. Enter the phone number of the paging service. Press **ACCEPT**.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	PAGER SERVICE PHONE NUMBER: 555-5555	CLEAR ENTRY
CANCEL		
	(USE NUMERIC KEYPAD)	

3. Enter the number of pagers to call when an alarm occurs. Press **ACCEPT**.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	NUMBER OF PAGERS: 3	CLEAR ENTRY
CANCEL		
	ENTER 1 - 3	

4. Enter the phone numbers of the individual pagers you wish to send the message to. This is usually the phone number that is given to the pager when it is purchased. Press **ACCEPT**.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	PAGER #1 PHONE NUMBER: 555-5555	CHANGE CHOICE
CANCEL		
	CHOICES: ENABLED, DISABLED	

6.2.2.7 Reporting Devices

The reporting order of the communication devices can be set to Modem Only, Pager Only, Pager Then Modem, and Modem Then Pager.

1. Press **CHANGE CHOICE** until the desired reporting method is displayed then press **ACCEPT**.

11:00 AM 21 - APR - 01		MODEM SETUP
ACCEPT	REPORTING ORDER: PAGER THAN MODEM	CHANGE CHOICE
CANCEL		
	CHOICES: MODEM AND / OR PAGER	

When the sampler calls the pager service, it will transmit a Pager Alarm Code number (Table 17) which corresponds to a specific alarm condition.

Table 17 Pager Alarm Codes

Alarm	Code	Equipment	Reason	Alarm	Code	Equipment	Reason
Low Main Battery	1	—	Battery pack is less than 11.5 V	High CH5	28	—	—
Memory Battery	2	—	Internal memory battery is low	High CH6	29	—	—
Low Slate Memory	3	—	Less than 10% slate memory left	High CH7	30	—	—
Slate Memory Full	4	—	Slate memory is used up	High Reference Temp.	31	—	—
Modem Failure	5	—	Modem chip/modem board failure	High Velocity	32	—	—
Missed Sample	6	—	No liquid detected when sampling	High D.O.	33	—	—
Purge Failure	7	—	Water present at sensors after purge	High D.O. Temp.	34	—	—
Jammed Distributor	8	—	Sensors indicate arm is not moving	High Conductivity	35	—	—
Bottle is Full	9	—	Full bottle option indicator is on	High Cond. Temp.	36	—	—
U-Sonic Echo Loss	10	—	No return signal detected	Low Level	37	—	—
Xducer Ringing	11	—	The return signal is detected too soon	Low Flow	38	—	—
U-Sonic failure	12	—	Ultrasonic board detects an error	Low pH/ORP	39	—	—
RS485 Timed Out	13	—	Communication problems with RS485	Low Process Temp.	40	—	—
Unable to Cool	14	AWRS only	Too high temperature in a compartment	Low CH1	41	—	—
Unable to heat	15	AWRS only	Too cold a temperature in compartment	Low CH2	42	—	—
Low Bubbler Pres.	16	(not applicable)	Possible leak in bubble tank	Low CH3	43	—	—
Clogged Bubbler	17	(not applicable)	Bubbler tube is plugged	Low CH4	44	—	—
High Level	18	—	—	Low CH5	45	—	—
High Flow	19	—	—	Low CH6	46	—	—
High Flow Rate of Change	20	—	—	Low CH7	47	—	—
High pH/ORP	21	—	—	Low Reference Temp.	48	—	—
High Process Temperature	22	—	—	Low Velocity	49	—	—
High Rainfall	23	—	—	Low D.O.	50	—	—
High CH1	24	—	—	Low D.O. Temp.	51	—	—
High CH2	25	—	—	Low Conductivity	52	—	—
High CH3	26	—	—	Low Cond. Temp.	53	—	—
High CH4	27	—	—				

6.3 4–20 mA Option

The 4–20 mA option provides a current loop for controlling external devices such as a chart recorder or PC. Either one or both of the 4–20 mA outputs can be factory installed and are isolated from each other.

The interface has a 3 ft cable with a connector on one end, and a 10 ft cable with two open wire leads on the other. Insert the connector into the sampler receptacle labeled “Auxiliary”, located on the left side of the control housing. On the 10 ft cable, the wire with clear insulation is positive (+) and the wire with black insulation is negative (–).

Table 18 4–20 mA Connections (J-18)

Pin	Signal Description	Wire Color
A	Output 1 + (pos)	Yellow
B	Output 1 – (neg)	Black
C	Output 2 + (pos)	Red
D	Output 2 – (neg)	Green

Rating:

- Isolation Voltage:
  Between sampler and either 4–20 mA output: 2500 V ac
  Between the two 4–20 mA outputs: 1500 V ac
- Maximum Resistive Load: 600 ohm
- Output Voltage: 24 V dc - no load

Cable Required
4–20 mA Interface Cable (Cat. No. 2924), 25 ft long, 4-pin connector on one end, tinned wire leads on the other end.

6.3.1 4–20 mA Programming

1. From the Main Menu, select **OPTIONS > ADVANCED OPTIONS > 4–20 MA OUTPUTS > SELECT**.

Note: *When the 4–20 mA outputs are disabled and not completely turned off, they will continue to output a steady 4 mA.*

2. Enable the 4–20 mA outputs by pressing **CHANGE CHOICE** while in the 4–20 mA output menu.
3. When the display shows the outputs as enabled, press **ACCEPT**.
4. Choose either Output A or Output B. Use the **UP** and **DOWN** keys to highlight the choice, then press **SELECT.**

5. Select an analog Input Channel (e.g., channel 1, 2, 3, or, flow, etc.) to assign to that output. Press **CHANGE CHOICE** to cycle through the channel names. When the desired channel is displayed, press **ACCEPT**.

11:00 AM 21 - APR - 01		4–20 mA OUTPUTS
ACCEPT	INPUT CHANNEL: FLOW	CHANGE CHOICE
CANCEL		
	SELECT APPROPRIATE UNITS	

6. Assign a channel value to the 4 mA current value. This value is typically 0, however any value can be set. Enter the value of the input needed to generate 4 mA of current at the output.

11:00 AM 21 - APR - 01		4–20 mA OUTPUTS
ACCEPT	4 mA INPUT VALUE	
CLEAR ENTRY	0.00 mgd	CANCEL
	SELECT APPROPRIATE UNITS	

7. Assign an input value to the 20 mA current level.

8. Repeat this process to configure the other 4–20 mA output.

6.3.2 4–20 mA Calibration

After wiring the 4–20 mA connection perform a 4–20 mA output calibration. The 4–20 mA output calibration requires a multimeter and an interface or access to the 4–20 mA current loop wiring. Two 4–20 mA outputs are available and are designated Output A and Output B. Both outputs are calibrated the same way and are isolated from each other.

Calibration may be performed while the 4–20 mA device is in the current loop, as shown in Figure 25 or disconnected from the current loop as shown in Figure 26. In either case, the multimeter must be set to a 20 milliamp dc range or greater.

1. From the Main Menu, select **OPTIONS > ADVANCED OPTIONS > CALIBRATION > 4–20 MA OUTPUTS.**

2. Connect a multimeter to the 4–20 mA current outputs per Figure 25 and Figure 26.

3. Make sure that the 4–20 mA output is enabled. If it is not enabled, press **CHANGE CHOICE** so that the display shows Enabled and press **ACCEPT**.

4. Select the Output (A or B) to calibrate.

5. Press any key to set the selected output to 4.00 mA dc.

6. Measure the current on the selected output using the multimeter and enter the measured value using the numeric keypad. Press **ACCEPT**.

7. Press any key to set the output to 20.00 mA dc.

8. Measure the current on the selected output using the multimeter and enter the measured value using the numeric keypad. Press **ACCEPT** to complete the calibration.

By entering the measured current values, the microprocessor will electronically adjust the outputs to compensate for the difference between the measured values and the expected values.

Figure 25 Calibration with the Meter in the Loop

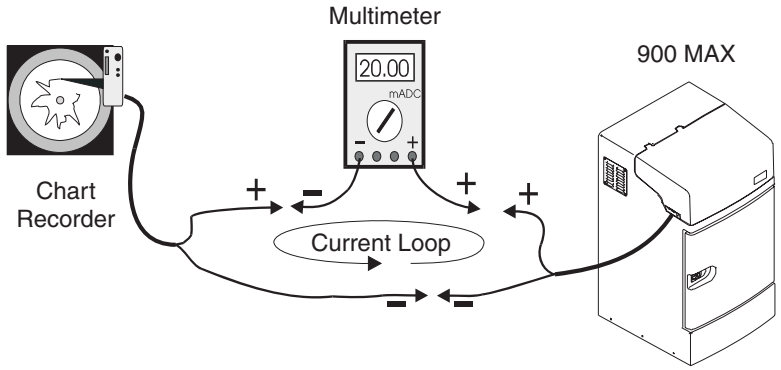
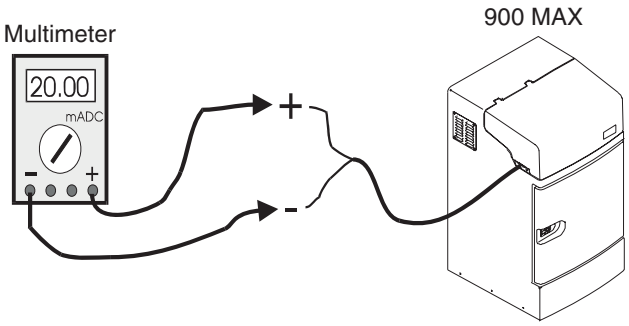


Figure 26 Calibration with the 4–20 mA Device Disconnected from the Loop



6.4 Alarm Relays

Note: *Current to the relay contacts must be limited to 5 amps. A means to remove power from the relays locally in case of an emergency or for servicing the product must be provided by the user. This can be accomplished with an external switch and a 5-amp fuse or with a switched 5-amp circuit breaker.*

Four alarm relay outputs are available as a factory installed option. The relays are mounted in an external NEMA 4X enclosure for installation to a wall or panel. Alarm contacts are rated for 10 amps at 240 V ac (resistive load).

The alarm wiring can be sized according to the load being used. The relay connector will accept wire sizes from 18–12 AWG with a rating of 300 V, 80 °C minimum. Do not use wire smaller than 18 AWG.

For relay pin assignments refer to Table 19 and Figure 27.

6.4.1 Alarm Relays Connection

Table 19 Relay Connector on the sampler (J17)

Pin	Signal Description	Wire Color
A	+12 V dc	Red
B	Relay #1	Yellow
C	Relay #2	Black
D	Relay #3	Red
E	Relay #4	Green

Figure 27 Relay Pin Connections

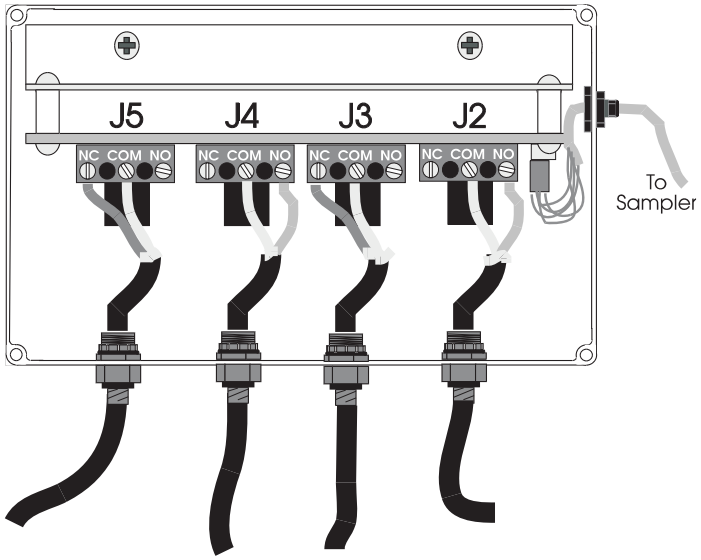


Table 20 Relays

Connector	Relay
J2	1
J3	2
J4	3
J5	4

Relay Junction Box

Required relay box is an alarm relay box assembly with a 10-ft long cable with a 6-pin connector on one end and a relay box on the other end (Figure 28).

1. Choose Normally Closed (NC) or Normally Open (NO) connections.

2. Hook into the terminal strip one wire in the common (COM) and the other in the connector with the preferred signal.

Figure 28 Single Relay Wiring Inside the Relay Junction Box

6.4.2 Alarm Relays Programming

Alarms can be programmed to activate based on certain conditions (low battery, low memory, etc.). When an alarm is tripped, an action is initiated (report via modem, dial a pager, or set a relay). There are two types of alarms:

- Trouble Alarms
- Set Point Alarms

6.4.2.1 Trouble Alarms

Trouble Alarms initiate an action when a trouble condition occurs. For example, a relay may close when the memory is full. Refer to Troubleshooting and Error Messages on page 127 for more information on trouble alarms.

1. From the Main Menu, select **SETUP > ADVANCED OPTIONS > ALARMS.**
2. Select one of the trouble conditions.
3. Select an action to occur when the alarm is activated. The list below shows each Trouble Condition. Refer to Appendix C on page 127 for causes and solutions.

Trouble Condition

- Low Main Battery
- Low Slate Memory
- Modem Failure
- Purge Failure
- RS485 Timed Out
- Memory Battery
- Slate Memory Full
- Missed Sample
- Jammed Distributor

Alarm Actions

- Set Relay #1
- Set Relay #2
- Set Relay #3
- Set Relay #4
- Report Via Modem

6.4.2.2 Set Point Alarms

Set Point Alarms look for trip points to be reached (either high or low or both) before initiating an action. For example an initiated action may be the closing of a relay when the water level exceeds 60 cm (24 in.) or drops below 10 cm (4 in.). Set Point Alarms activate when a user-definable high and/or low set point is reached.

1. Enable one of the alarm conditions.
2. Select an action to occur when the alarm is activated.
3. Set either a High trip point or a Low trip point.
4. After entering the trip point enter the deadband value.

Note: *Log rainfall to use an alarm on a rainfall condition; likewise, log flow in order to implement and alarm on a flow rate of change.*

Set Point Alarm Conditions:

- Level
- Flow
- Flow Rate of Change
- pH
- ORP
- Process Temperature
- Rainfall
- Cabinet Temperature (refrigerated samplers)
- Analog Channels 1–3
- Analog Ch. 4 or D.O.
- Analog Ch. 5 or D.O. Temp.
- Analog Ch. 6 or Conductivity
- Analog Ch. 7 or Conductivity Temp.

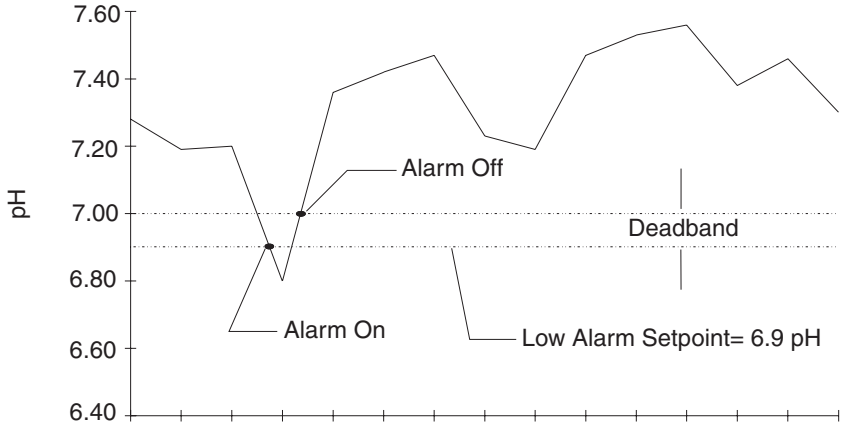
Note: *Rainfall and Flow Rate of Change alarms are HIGH set point conditions; they take no deadband and they are time dependant.*

Deadband
After entering the trip point, enter a deadband value. The deadband is the area between alarm “turn-on” and “turn-off”.

The purpose of setting the deadband is to eliminate alarm chatter which may occur if the “turn-on” and “turn-off” values are too close together. Small fluctuations occurring when the reading is at or near the trip point can rapidly toggle an alarm relay on and off.

In the pH example (Figure 29) the deadband is set to 0.10 pH. When the pH reached 6.9 (lower dashed line), the alarm tripped, but the alarm did not turn off until the pH came back up to 7.00. This difference is the deadband setting which should be set according to the characteristics of the item being measured.

Figure 29 Deadband Concept



6.5 Analog Inputs

6.5.1 Analog Inputs Connection

Note: *4–20 mA inputs must be isolated. Maximum load per unit is 200 ohms.*

Analog voltage as well as analog current input signals are accommodated in a single connector. To connect the analog voltage signal (–4.0 to +4.0 V dc):

1. Tie ground wire to Pin B (ground).
2. Tie analog voltage wire to the appropriate voltage input pin (Pin C, E, or G).

For example, to connect an analog voltage input to analog input channel 1, tie the ground wire to pin B and your positive wire to pin C.

To connect and analog current signal (4–20 mA dc)

1. Tie ground wire to Pin B (ground).
2. Connect analog current wire to both voltage and current input pins for the appropriate channel (Pin C and D, or E and F, or G and H).

Table 21Analog Input Pin Assignments

Pin	Signal Description	Wire Color
A	+12 V dc	White
B	Signal Ground	Blue
C	Voltage Input 1 (–4.0 V dc to +4.0 V dc)	Yellow
D	Current Input 1 (4–20 mA dc)	Black
E	Voltage Input 2 (–4.0 V dc to +4.0 V dc)	Red
F	Current Input 2 (4–20 mA dc)	Green
G	Voltage Input 3 (–4.0 V dc to +4.0 V dc)	Gray
H	Current Input 3 (4–20 mA dc)	Brown
J	not used	Violet
K	not use	Orange
Note: *There is no pin labeled "I".*		

There are a total of three analog input channels available on the sampler. These inputs accept 4–20 mA dc or –4.0 to +4.0 V dc analog signals. They can be logged and graphed and can also be used to trigger alarms, cause setpoint samples, and control 4–20 mA outputs.

6.5.2 Analog Inputs Programming

Analog input channels can accept a signal from an external device. This signal may range from –4.0 V dc (min) to +4.0 V dc (max) or from 4 to 20 mA dc depending on the input selected. In some cases, input signals from certain devices may also fall somewhere within those ranges. For that reason, each analog input channel must be mapped to the minimum and maximum signal limits of the external device.

To map an external device to an analog input channel:

1. From the Main Menu, select **OPTIONS>ADVANCED OPTIONS>DATALOG.**
2. Highlight Select Inputs using the **UP** and **DOWN** keys and press **SELECT**.
3. Highlight the analog channel to log using the **UP** and **DOWN** keys, then press **SELECT**.
4. Press **CHANGE CHOICE** to cycle between Logged and Not Logged, then press **ACCEPT**.
5. Enter a Logging Interval using the numeric keypad. Press **ACCEPT**.
6. Select unit of measurement (ppm, ppb, afd, cfs, cfm, cfd, cms, cmm, cmh, cmd, gps, gpm, gph, lps, lpm, lph, or mgd).
7. Enter Low Point.
8. Enter High Point.
9. Select another channel to configure, or press **RETURN** to back up one step, or press **MAIN MENU** to return to the Main Menu display.

Note: *If logging is enabled on any channel, then that channel will have an arrow in front of the channel name to signify the channel is logged.*

MAINTENANCE

DANGER

Some of the following manual sections contain information in the form of warnings, cautions and notes that require special attention. Read and follow these instructions carefully to avoid personal injury and damage to the instrument. Only personnel qualified to do so, should conduct the installation/maintenance tasks described in this portion of the manual.

DANGER

Certains des chapitres suivants de ce mode d'emploi contiennent des informations sous la forme d'avertissements, messages de prudence et notes qui demandent une attention particulière. Lire et suivre ces instructions attentivement pour éviter les risques de blessures des personnes et de détérioration de l'appareil. Les tâches d'installation et d'entretien décrites dans cette partie du mode d'emploi doivent être seulement effectuées par le personnel qualifié pour le faire.

PELIGRO

Algunos de los capítulos del manual que presentamos contienen información muy importante en forma de alertas, notas y precauciones a tomar. Lea y siga cuidadosamente estas instrucciones a fin de evitar accidentes personales y daños al instrumento. Las tareas de instalación y mantenimiento descritas en la presente sección deberán ser efectuadas únicamente por personas debidamente cualificadas.

GEFAHR

Einige der folgenden Abschnitte dieses Handbuchs enthalten Informationen in Form von Warnungen, Vorsichtsmaßnahmen oder Anmerkungen, die besonders beachtet werden müssen. Lesen und befolgen Sie diese Instruktionen aufmerksam, um Verletzungen von Personen oder Schäden am Gerät zu vermeiden. In diesem Abschnitt beschriebene Installations- und Wartungsaufgaben dürfen nur von qualifiziertem Personal durchgeführt werden.

PERICOLO

Alcune parti di questo manuale contengono informazioni sotto forma d'avvertimenti, di precauzioni e di osservazioni le quali richiedono una particolare attenzione. La preghiamo di leggere attentivamente e di rispettare quelle istruzioni per evitare ogni ferita corporale e danneggiamento della macchina. Solo gli operatori qualificati per l'uso di questa macchina sono autorizzati ad effettuare le operazioni di manutenzione descritte in questa parte del manuale.

CAUTION
Always disconnect power to the sampler before performing any maintenance or service.

7.1 Cleaning the Sampler

7.1.1 Cleaning the Refrigerator

Clean the condenser fins and coils every 6 to 8 months to maintain efficient heat transfer.

7.1.2 Cleaning the Sampler Cabinet

Clean the interior and exterior of the sampler cabinet with a damp sponge and mild detergent. Do not use abrasive cleaners.

7.1.3 Cleaning the Sample Bottles

Clean the bottles using a brush and water with a mild detergent, followed by a fresh water rinse and a distilled water rinse. Glass bottles may also be autoclaved.

7.1.4 Cleaning the Intake Tubing and Pump Tubing

Clean the tubing by pumping water with mild detergent or other cleaning solution through the tubing, using the peristaltic pump in Manual Pump Mode. Press **MANUAL MODE**.

7.1.5 No Lubrication Required

The sampler **does not** require routine lubrication. Do not lubricate the pump tube with petroleum jelly, silicone grease, oil, or any other lubricant, as this will substantially reduce the life of the pump tube and roller assembly.

If you need assistance in performing any of the following service steps, please contact the factory.

7.2 Pump Tubing Maintenance

CAUTION
Always disconnect power to the sampler before removing the pump cover.

Replacement pump tubing is available from the manufacturer in 15' bulk length (Cat. No. 4600-15), and 50' bulk length (Cat. No. 4600-50). Use of tubing other than that supplied by the manufacturer may cause excessive wear on mechanical parts and/or poor pump performance.

7.2.1 Tubing Life Estimates

Pump tubing life depends on several factors:

- Distance from sample source. Locate the sampler as close to the sample source as possible.
- Vertical lift. Minimize the vertical lift (ideally, 15 feet or less).
- Intake Rinses. Minimize the number of intake rinses prior to sample collection.
- Pump roller assembly condition. Remove (clean) the silicone residue in the interior of the pump housing and on the rollers before installing a new tube.

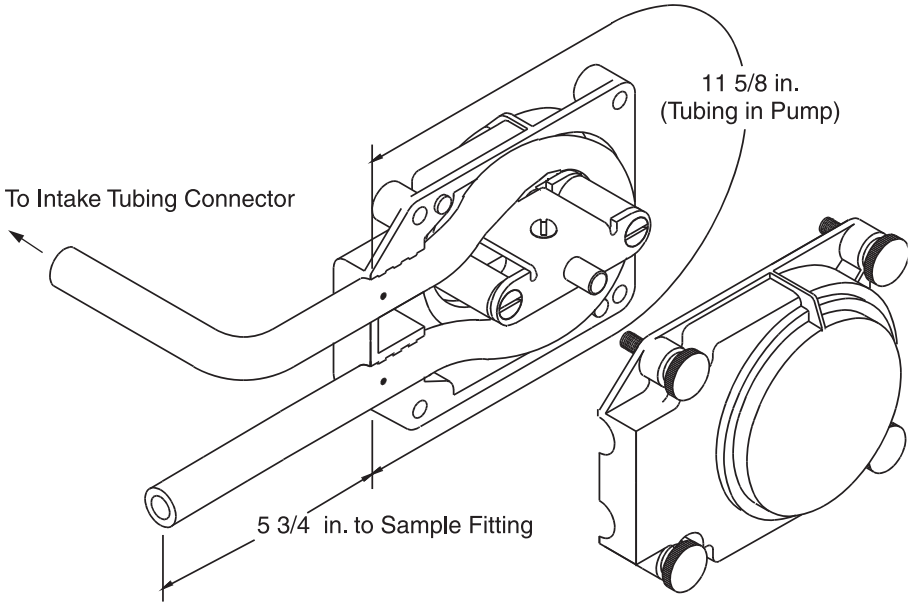
- Constituents in the sample liquid. Grit and other abrasive solids cause greater wear on the tubing as they are squeezed through the pump rollers.

Note: *To extend the life of the tubing, rotate the pump tube 90 degrees in the pump housing after approximately 2/3 of the life has been realized (once the tube life has been determined through use).*

Experience at a particular site will be your best indicator of tubing life. Visually inspect the tubing and rollers on a regular basis after initial installation to get a feel for what maintenance your site will require. Be sure to replace the pump tubing before it splits to prolong the life of the sampler and keep the work area free of contamination from the sample liquid.

Proper length of silicone tubing must be used in the pump body. An improper length can reduce the life of the tubing and pump rollers. Refer to Figure 30 for the correct length.

Figure 30 Pump Tube Loading



7.2.2 Replacing Pump Tubing

1. To replace the pump tube, remove the four screws on the pump cover.
2. Remove the front cover of the pump housing.
3. Remove the existing tubing. Locate the black dot on the new tubing. The end of the tube that extends farthest beyond the black dot attaches to the stainless steel tubing connector.
4. Install the pump tube in the pump housing until the black dots are visible just outside the pump body.
5. After inserting the new pump tube, reinstall the front cover and secure it with the four screws until finger tight.

7.3 Upgrades, Repairs, General Maintenance

Only a qualified technician should service the sampler. For example, steps that require knowledge of CMOS electrostatic discharge precautions and advanced electronics training and should only be performed by a qualified technician. If you need assistance in performing any of the following service steps, contact the manufacturer.

Electrostatic Discharge (ESD) Considerations

To minimize ESD risks, maintenance procedures not requiring power to the sampler should be performed with power removed.

Delicate internal electronic components can be damaged by static electricity, resulting in degraded instrument performance or eventual failure.

The manufacturer recommends taking the following steps to prevent ESD damage to your instrument:

- Before touching any instrument electronic components (such as printed circuit cards and the components on them) discharge static electricity from your body. This can be accomplished by touching an earth-grounded metal surface such as the chassis of an instrument, or a metal conduit or pipe.
- To reduce static build-up, avoid excessive movement. Transport static-sensitive components in anti-static containers or packaging.
- To discharge static electricity from your body and keep it discharged, wear a wrist strap connected by a wire to earth ground.

Handle all static-sensitive components in a static-safe area. If possible, use anti-static floor pads and work bench pads.

7.4 Internal Maintenance Items

The following items require access to the inside of the case for service:

- Fuses for the RS485 and analog interface connectors (if equipped)
- Internal desiccant module
- RAM memory batteries
- System upgrades (4–20 mA, modem, alarm relays, etc.)
- Circuit board repair

7.5 Removing and Opening the Controller

CAUTION
Always power the unit OFF and then disconnect all cables from the sampler before removing the controller.

To remove the controller from the controller center section:

1. Turn the unit off by pressing the **OFF** key.
2. Disconnect and remove all cables to the controller housing, including the distributor/full bottle shutoff cable.
3. Disconnect all tubing.

Note: *The front panel gasket has a light coating of grease to help assure a watertight seal. Do not contaminate the grease or gasket area with dirt or debris during servicing. Always replace the gasket if it is damaged or missing. Never reassemble the case without the gasket properly installed.*

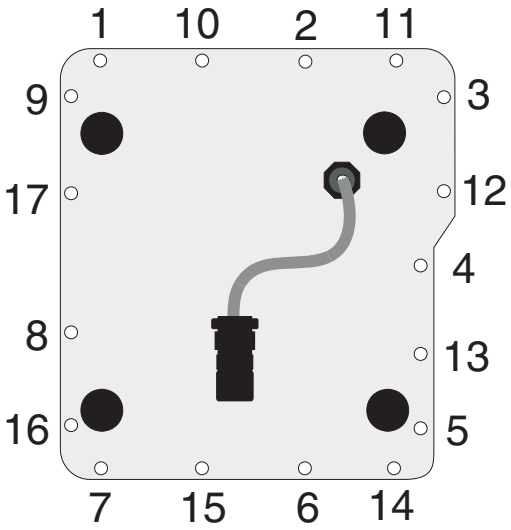
4. Remove the front clip holding the controller housing to the top of the cabinet.
5. Lift the controller off the cabinet using care to guide the distributor/full bottle shut-off cable through the hole in the refrigerated compartment.
6. Remove the 17 screws from around the perimeter of the controller back panel.
7. Carefully pull open the bottom panel and let the attached connectors swing out of the way.
8. If necessary for the repair being performed, unplug the appropriate connectors. Always note each connector location before unplugging anything. **Re-installing a plug into the wrong connector can cause extensive damage.**

7.6 Re-installing the Bottom Panel

Note: *Always follow the procedure below when re-installing the sampler bottom panel. Improper panel installation may result in damage to the instrument.*

1. Hand tighten each nut until it makes contact with the panel.
2. Tighten the nuts in sequence shown in Figure 31 to 5 in.-lb (0.56 N-m).
3. Repeat the tightening procedure in the same sequence to 10 in.-lb (1.13 N-m).

Figure 31 Tightening the Nuts on the Bottom Panel



7.7 Circuit Board Identification

There are two main circuit boards in the sampler; the Utility Board and the CPU board. The CPU board is attached to the bottom panel and the Utility board is located inside the control housing behind the motor/gearbox assembly.

Note: *Removal and handling of the circuit boards used in the sampler requires knowledge of ESD (Electro-Static Discharge) precautions and the CMOS (Complementary Metal-Oxide Semiconductor) circuit components used in the sampler. Static electricity has the potential to damage the CMOS components of the sampler when the boards are unplugged and removed from the case. Precautions must be taken to assure static free personnel and work area prior to handling the circuit boards.*

Figure 32 CPU Board

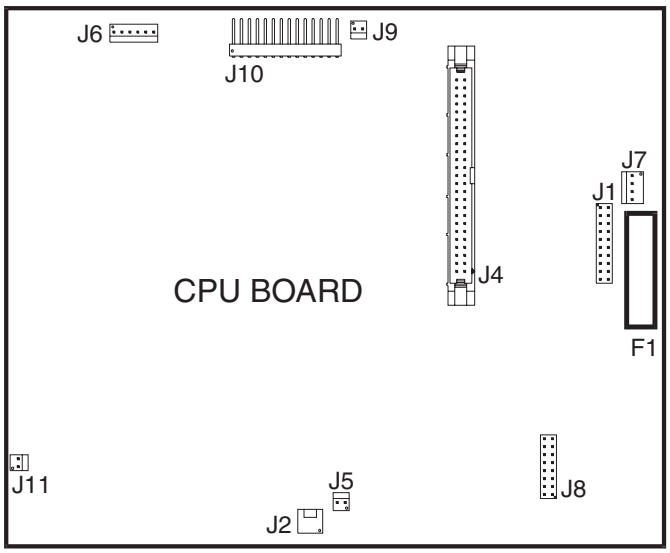


Table 22 CPU Board Connectors

ID	Description	ID	Description
J-1	Liquid Crystal Display	J-7	RS485 Submerged Pressure Transducer
J-2	Mechanical Totalizer	J-8	Modem Option Module
J-3	not used	J-9	Liquid Crystal Display (LED back-light)
J-4	Base Board	J-10	Keypad
J-5	Memory Backup Battery Pack	J-11	not used
J-6	RS232 Serial Port		

Figure 33 Utility Board

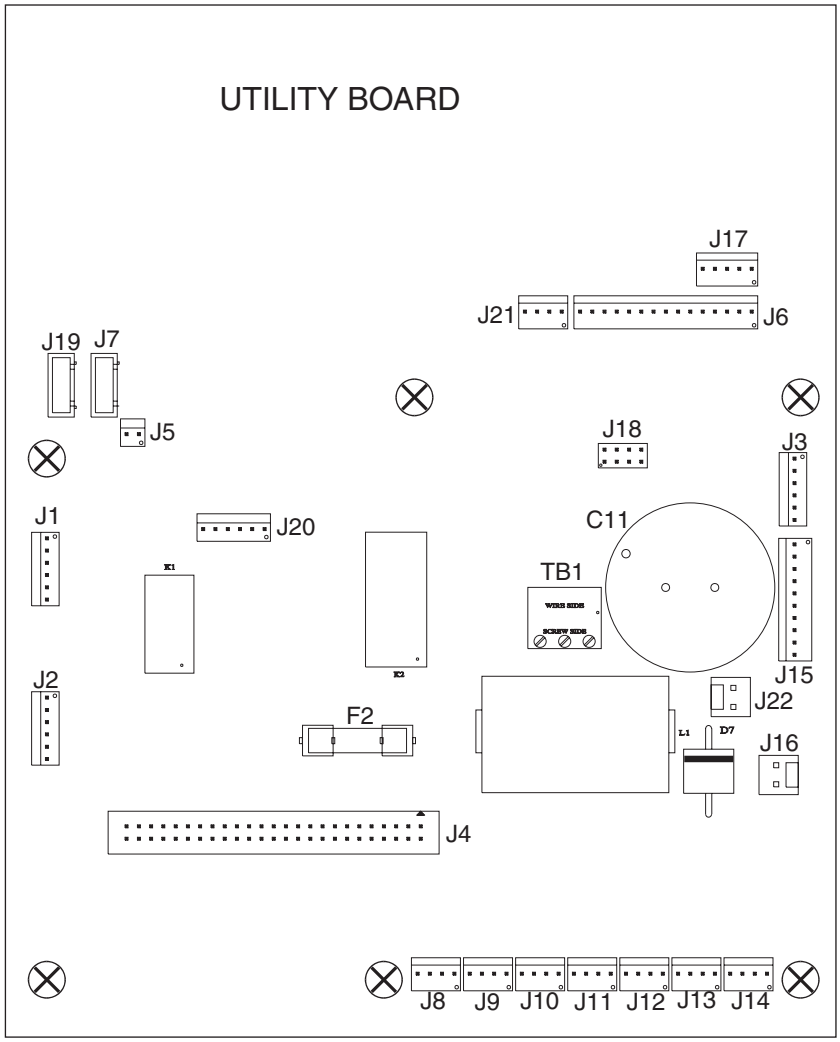


Table 23 Utility Board Connections

ID	Description	ID	Description
J-1	Distributor	J-12	Analog Input Channel 5
J-2	Auxiliary	J-13	Analog Input Channel 6
J-3	pH/ ORP	J-14	Analog Input Channel 7
J-4	CPU Board	J-15	Thermal Control
J-5	Rain Gauge	J-16	12 V dc Main
J-6	Bubbler Module	J-17	Relay Output
J-7	Fluid Sensor #1	J-18	4–20 mA PCB
J-8	Analog Input Channel 1	J-19	Fluid Sensor #2 (closest to pump)
J-9	Analog Input Channel 2	J-20	D.O. / Conductivity
J-10	Analog Input Channel 3	J-21	Submerged Sensor
J-11	Analog Input Channel 4	J-22	5 amp External Fuse

7.8 Replacing the Fuse

DANGER
For continued protection against fire, replace fuses with only fuses of specified type and current rating.

5-amp Medium Delay Fuse (Cat. No. 8753)
The main 12 volt line is fused as soon as it enters the controller housing. This is a 5 amp medium delay fuse and is accessible from outside the case on the back side of the controller housing. To remove the fuse unscrew the cap on the fuse holder with a flat blade screwdriver.

PCB Fuse Removal and Inspection
Pull the fuse straight out of the holding clips to remove the fuse. The wire strand inside the glass tube will be broken. Use an ohmmeter to tell for sure if a fuse needs to be replaced.

7.9 Motor/Gear Box

The motor/gear box requires no regular maintenance. The special formulation gears are self lubricating and require no oil or grease.

7.10 Internal Desiccant Module

Note: *The desiccant module cannot be recharged by heating. Do not attempt to bake the desiccant module in an oven to remove the moisture as this could be a fire hazard.*

The Internal Desiccant Module (Cat. No. 8849) consists of a moisture-absorbent material inside a poly bag. If the humidity indicator on the front panel turns pink, replace the module and the back panel perimeter gasket (Cat. No. 8606). The desiccant module is located under the CPU board.

7.10.1 Internal Case Humidity Indicator

After replacing the desiccant module and re-sealing the case, the Internal Case Humidity indicator disc (Cat. No. 2660) should return to its original blue color. Replace the indicator disc if it fails to return to blue after replacing the desiccant module. To replace the indicator disc, remove the bottom panel that is held in place by a small clip and screw.

7.11 Memory Battery

Random Access Memory (RAM) is a very reliable data storage medium for microprocessor applications. However, RAM requires power at all times. If power is removed, the data stored in the RAM chip is lost. Therefore, you cannot power the RAM chips from the sampler power supply because you would lose data and program settings every time you unplugged the power cord. A separate battery located inside the sampler controller is provided to power the RAM chips and the real-time clock. The memory battery keeps the program entries and logged sample data alive inside the RAM memory when the main power fails or is removed for transport or replacement.

The sampler memory battery consists of two C-cell batteries.

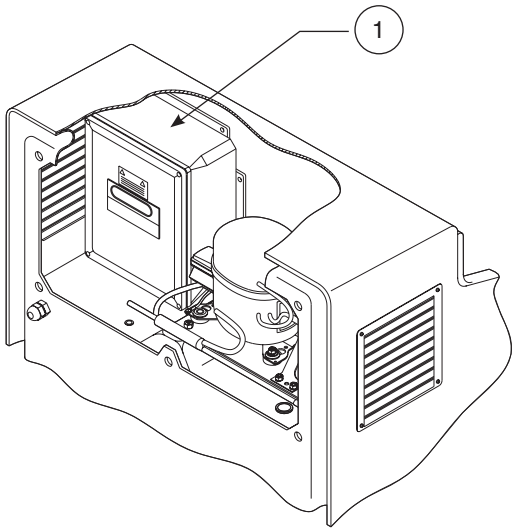
Should the memory battery voltage fall too low to properly maintain the program settings, a warning: **MEMORY POWER LOW** will alert you to replace the batteries. The sampler utilizes a very small amount of energy from the memory batteries during normal operation. The service life of the batteries in this application is typically five years.

7.12 Resetting the Circuit Breaker

DANGER
Disconnect ac power from sample before attempting to reset the internal circuit breaker.

1. Disconnect ac power from the unit.
2. Remove the six screws holding the louverd panel to the upper rear surface of the unit.
3. Loosen the four screws holding the cover Power Junction Assembly Thermal Switch Control box which is located un the upper left corner of the unit (Figure 34).
4. The circuit breaker is located on the inside left wall of the Power Junction Assembly Thermal Control box. Reset the circuit breaker by placing the handle in the up (ON, 1) position.
5. Reinstall the Power Junction Assembly Thermal Control box cover.
6. Install the louvered rear panel.
7. Connect ac power to the unit.

Figure 34 Power Junction Assembly Thermal Control Box

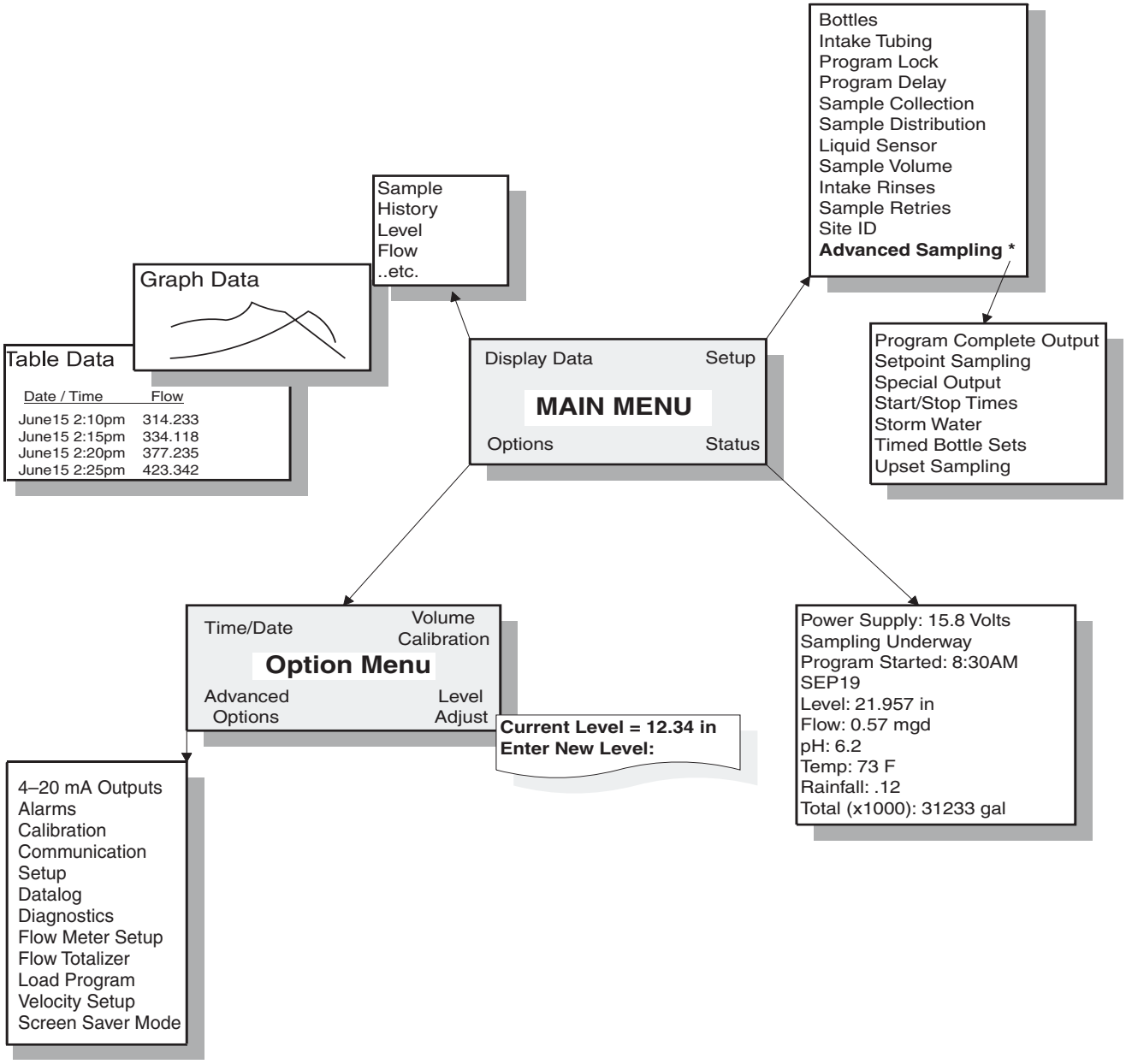


1.	Power Junction Assembly Thermal Control Box

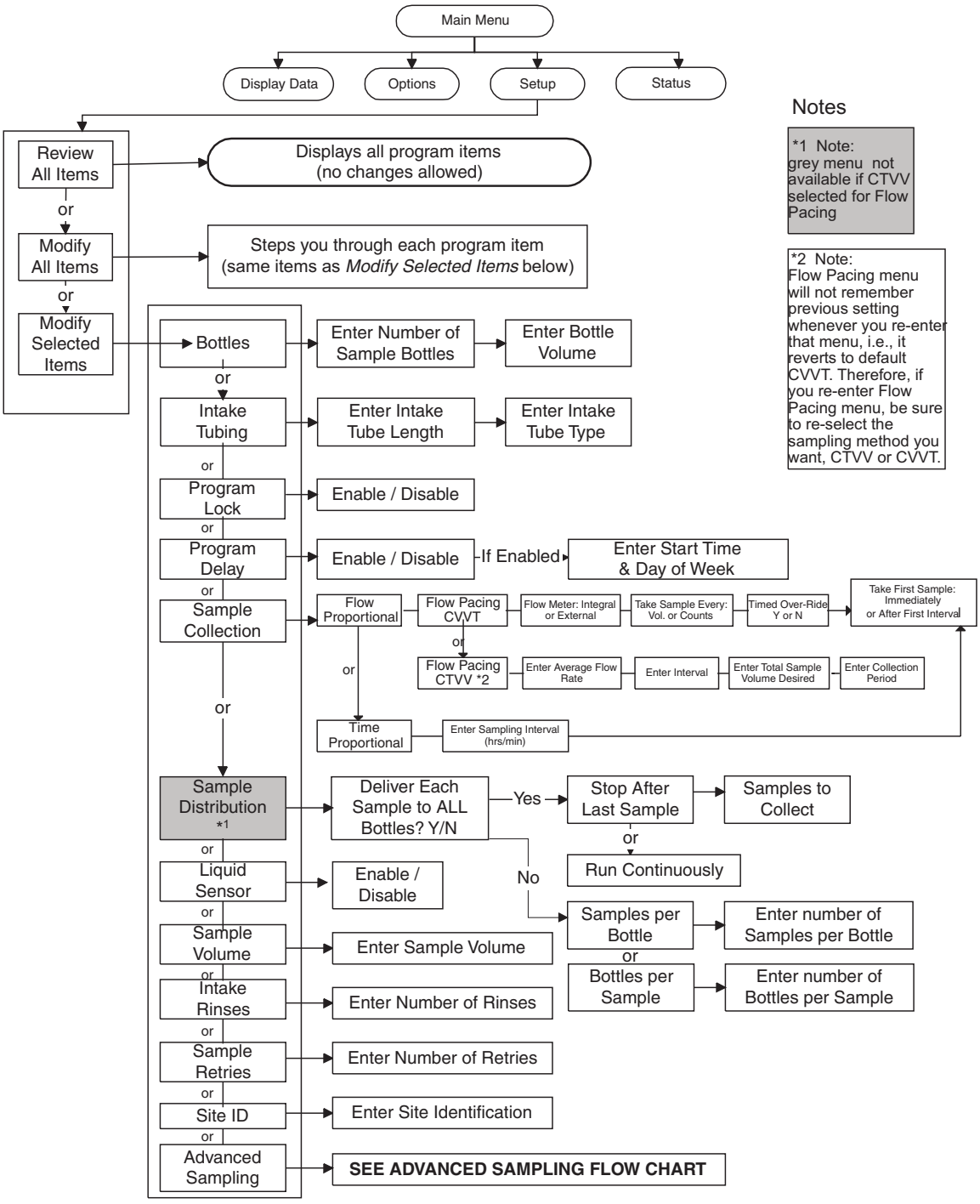
Appendix A Quick Start Guides

For best results, read the instrument manual before beginning. Use this guide as a reminder.

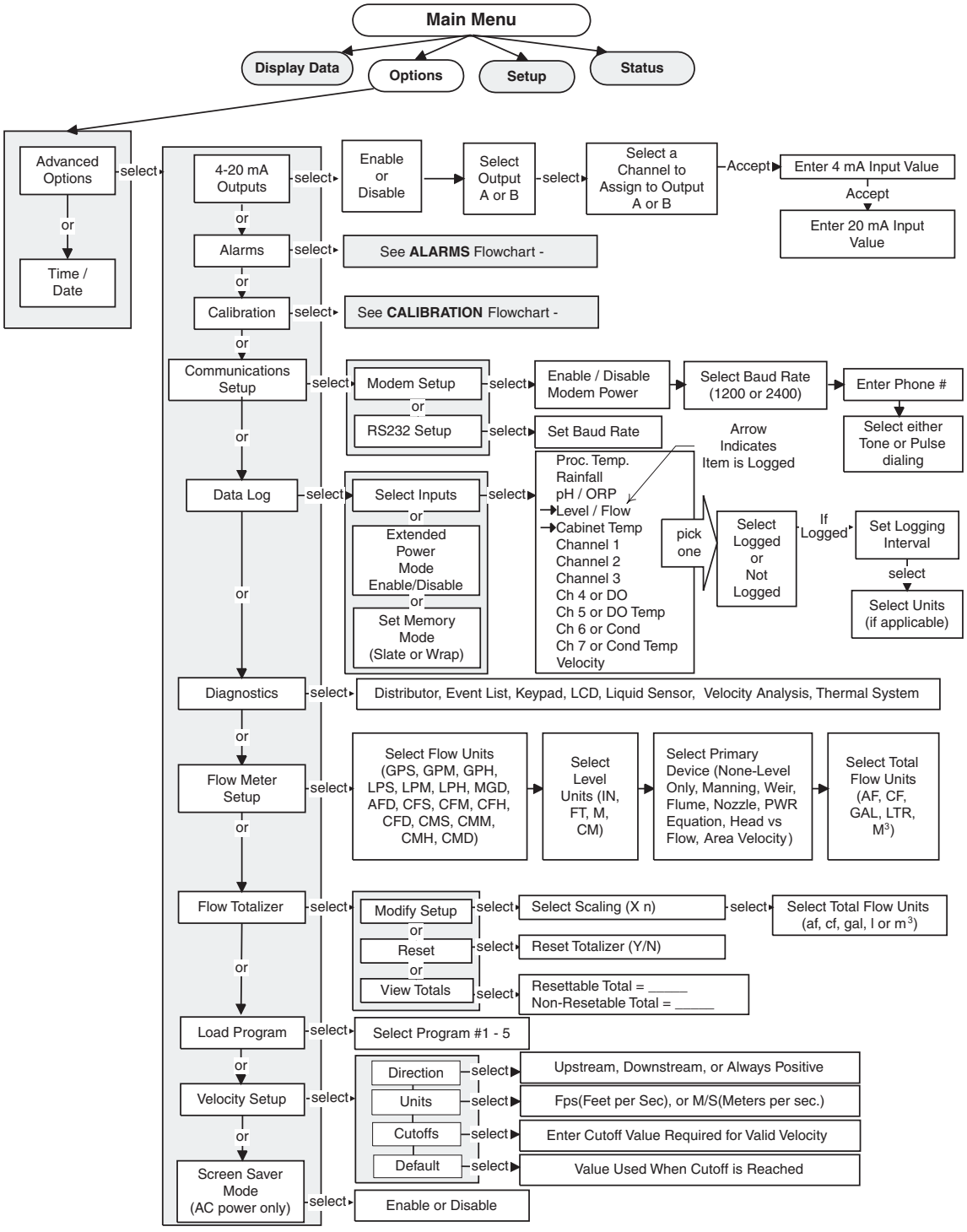
Main Menu Flow Chart



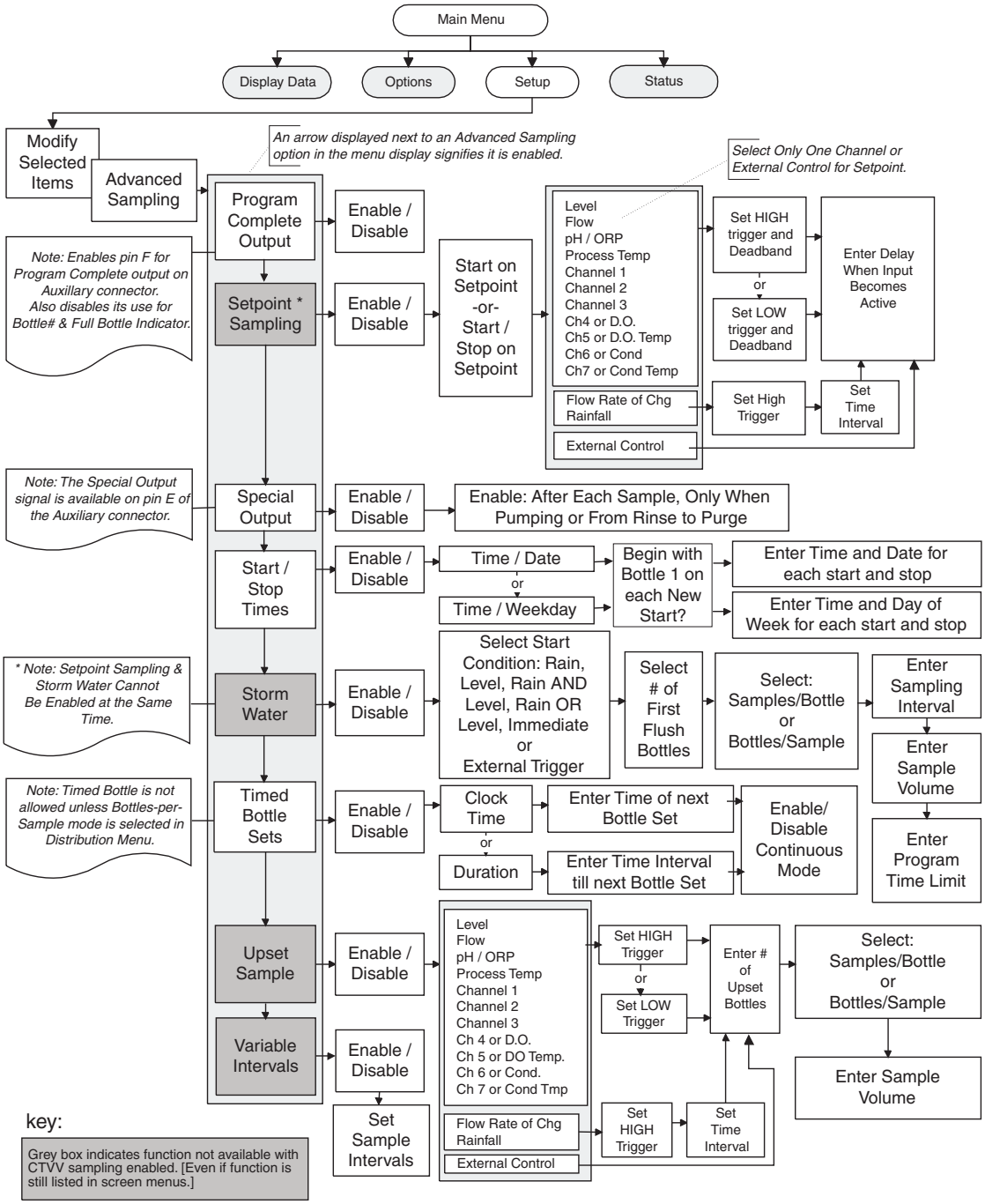
Setup Flow Chart



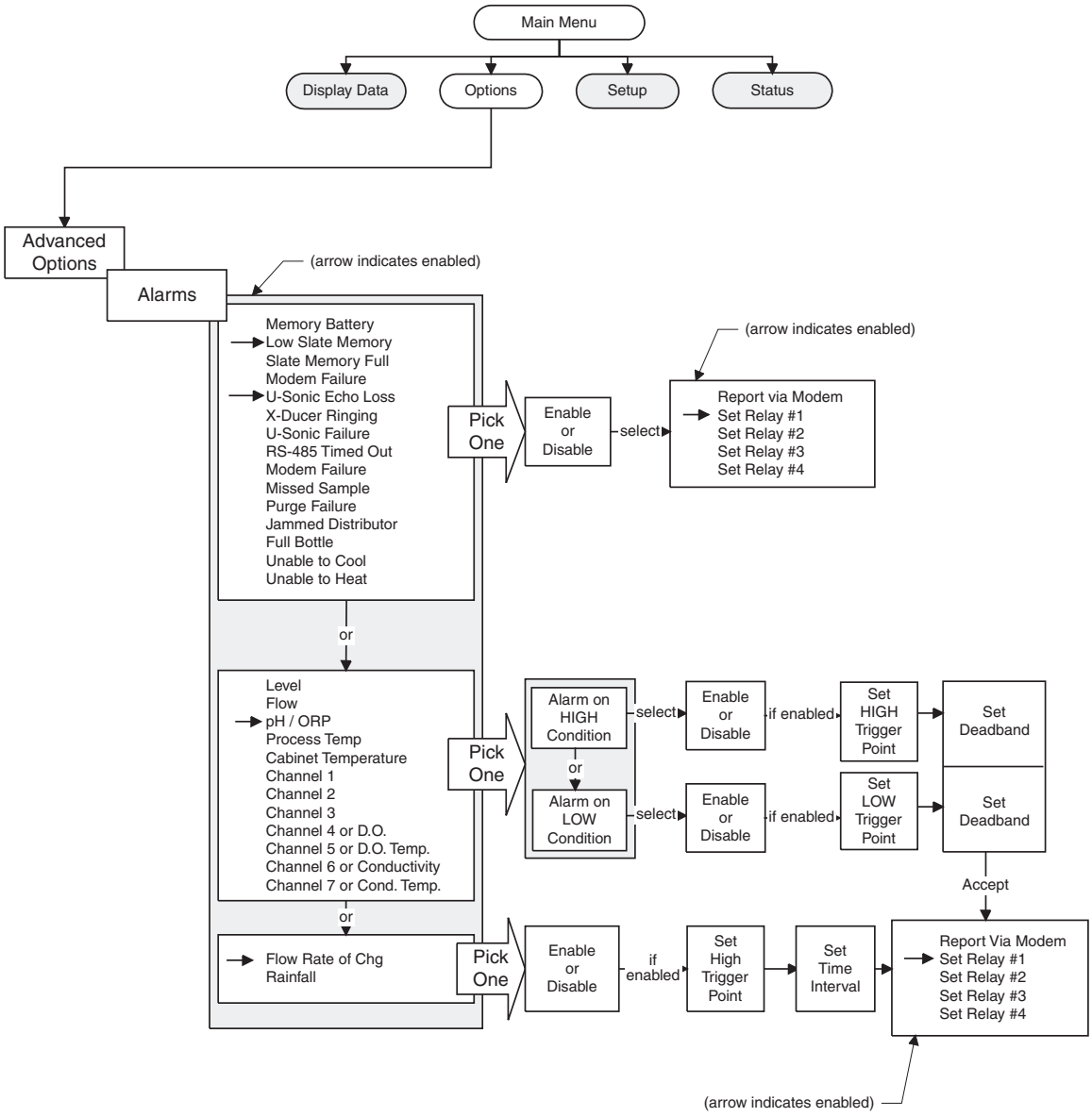
Options Flow Chart



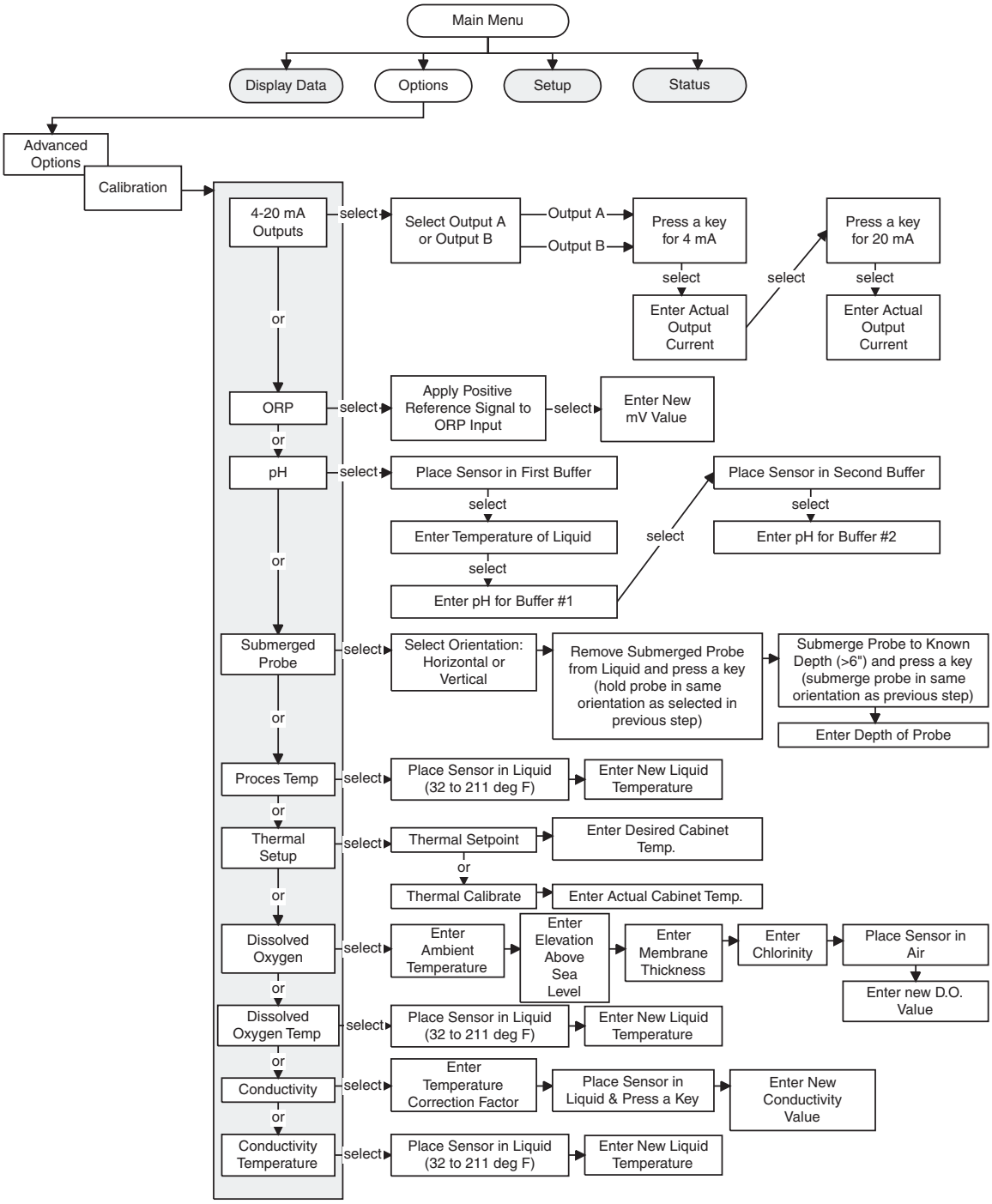
Advanced Sampling Flow Chart


Main Menu
Display Data
Options
Setup
Status
Modify Selected Items
Advanced Sampling
An arrow displayed next to an Advanced Sampling option in the menu display signifies it is enabled.
Select Only One Channel or External Control for Setpoint.
Program Complete Output
Enable / Disable
Note: Enables pin F for Program Complete output on Auxillary connector. Also disables its use for Bottle# & Full Bottle Indicator.
Setpoint * Sampling
Enable / Disable
Start on Setpoint -or- Start / Stop on Setpoint
Level
Flow
pH / ORP
Process Temp
Channel 1
Channel 2
Channel 3
Ch4 or D.O.
Ch5 or D.O. Temp
Ch6 or Cond
Ch7 or Cond Temp
Flow Rate of Chg
Rainfall
External Control
Set HIGH trigger and Deadband
or
Set LOW trigger and Deadband
Set High Trigger
Enter Delay When Input Becomes Active
Set Time Interval
Note: The Special Output signal is available on pin E of the Auxiliary connector.
Special Output
Enable / Disable
Enable: After Each Sample, Only When Pumping or From Rinse to Purge
Start / Stop Times
Enable / Disable
Time / Date
or
Time / Weekday
Begin with Bottle 1 on each New Start?
Enter Time and Date for each start and stop
Enter Time and Day of Week for each start and stop
* Note: Setpoint Sampling & Storm Water Cannot Be Enabled at the Same Time.
Storm Water
Enable / Disable
Select Start Condition: Rain, Level, Rain AND Level, Rain OR Level, Immediate or External Trigger
Select # of First Flush Bottles
Select: Samples/Bottle or Bottles/Sample
Enter Sampling Interval
Enter Sample Volume
Enter Program Time Limit
Note: Timed Bottle is not allowed unless Bottles-per-Sample mode is selected in Distribution Menu.
Timed Bottle Sets
Enable / Disable
Clock Time
or
Duration
Enter Time of next Bottle Set
Enter Time Interval till next Bottle Set
Enable/ Disable Continuous Mode
Upset Sample
Enable / Disable
Level
Flow
pH / ORP
Process Temp
Channel 1
Channel 2
Channel 3
Ch 4 or D.O.
Ch 5 or DO Temp.
Ch 6 or Cond.
Ch 7 or Cond Tmp
Flow Rate of Chg
Rainfall
External Control
Set HIGH Trigger
or
Set LOW Trigger
Set HIGH Trigger
Set Time Interval
Enter # of Upset Bottles
Select: Samples/Bottle or Bottles/Sample
Enter Sample Volume
Variable Intervals
Enable / Disable
Set Sample Intervals
key:
Grey box indicates function not available with CTVV sampling enabled. [Even if function is still listed in screen menus.]

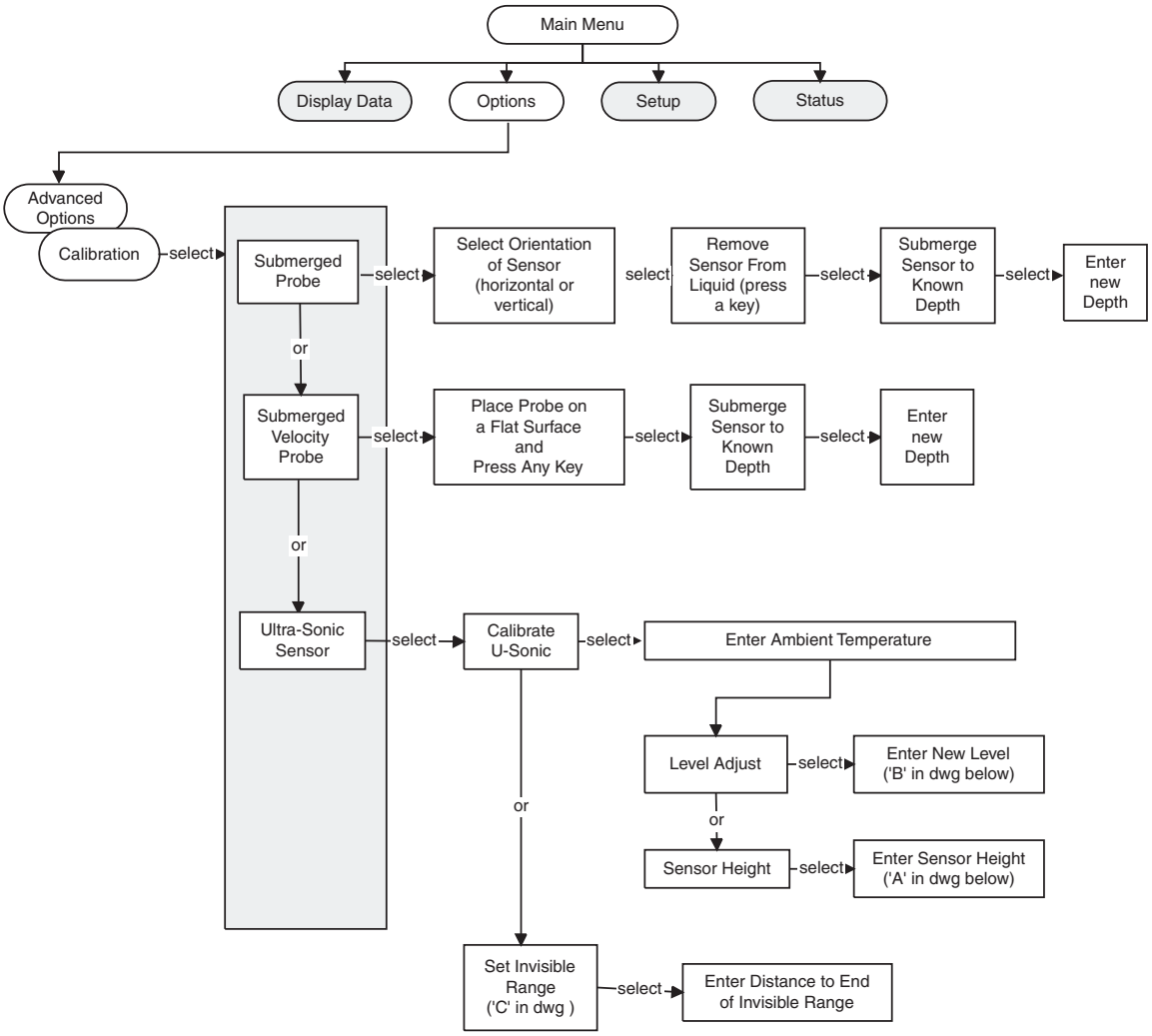
Alarms Flow Chart



Calibration Flow Chart (1 of 2)



Calibration Flow Chart (2 of 2)



Review All Items

This function lets you review all information in the Setup and Option menus without worrying about accidentally changing the information. Use this function to verify that the program is setup properly.

All program entries and the status of all logged channels are displayed. Since this information fills more than one screen, scroll through the setup information one page at a time with the **UP** and **DOWN** arrow keys.

11:00 AM 21 - APR - 01		SETUP REVIEW
900 MAX VERSION:	1.00	
NUMBER OF BOTTLES:	4	
BOTTLE VOLUME:	10.00 gal	
INTAKE TUBE LENGTH	50 ft	
INTAKE TUBE TYPE	3/8" VINYL	↓
PROGRAM LOCK	OFF	

When you get to the last screen you will see only an **UP** key meaning that you have now reached the last screen. Scroll back up the list or press the **MAIN MENU** key to exit.

11:00 AM 21 - APR - 01				SETUP REVIEW
CHANNEL 3	ppm	NOT LOGGED	1min	↑
CHANNEL 4	ppm	NOT LOGGED	1min	
CHANNEL 5	ppm	NOT LOGGED	1min	
CHANNEL 6	ppm	NOT LOGGED	1min	
CHANNEL 7	ppm	NOT LOGGED	1min	
MEMORY MODE		WRAP		

When you are satisfied that all program entries are set up properly, press the **MAIN MENU** key to exit this screen and return to the main menu.

Review All Items Screen Contents
The first line of the Setup Review screen shows the software revision level for the internal embedded software (firmware) of the sampler and should be noted before calling the factory.

Running a Program

Note: *When selecting Start from Beginning, all logged data will be cleared from memory. If this data needs to be saved make sure it is downloaded to a DTU or personal computer prior to pressing* ***START FROM BEGINNING****.*

To run or halt a program, press **RUN/STOP**. If the program has been stopped (and no changes to the program settings were made while it was stopped), pressing **RUN** will cause the program to ask to resume the previously running program (and retain all logged data) or Start From Beginning (and clear all logged data).

Displaying Data

The Display Data function provides the recorded data for any channel being logged in a tabular report or a graph.

In addition, for tabular reports, the data can be viewed from the beginning, from the end, or from a specific point in time. A graph can display any 24-hour period, zoom in to any portion of the 24-hour period for finer detail, or center the graph on a specific point in time.

Selecting the Channel

Note: *Only the channels for which logging has been enabled will be listed.*

1. Press **DISPLAY DATA** to display a list of logged channels.
2. Highlight the desired channel using the **UP** and **DOWN** keys. Press **SELECT**.

Tabular or Graph Format

1. Highlight the desired display method using the **UP** and **DOWN** keys then press **SELECT**.

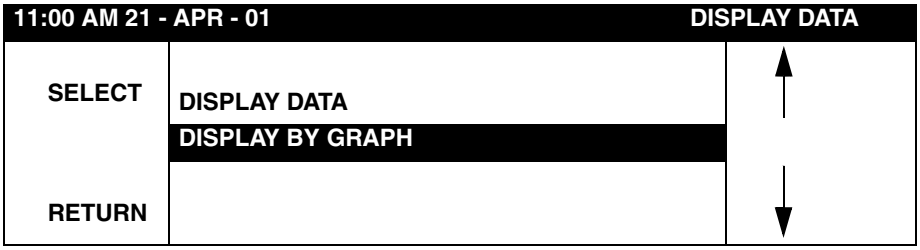


Table 24 Display Data Functions and Descriptions

Function	Description
Display Data by Table	
	View from start: Displays the data for the selected channel beginning with the first (oldest) data point in memory.
	View from end: Displays the data for the selected channel beginning from the most recent point in memory.
	View from time/date: Displays the data for the selected channel beginning from any desired time and date. Enters a new desired time and date.
	Note: *Totals displayed are calculated by summing the logged data. If the date selected precedes available logged data (memory has wrapped), the total will be incorrect.*
Display Data by Graph	
	Graph day: Displays data for a specified date. Data for the selected date is graphed from midnight to midnight.
	Graph point in time: Displays data for a specified time and date. The graph displays three hours of data with the selected point in the time at the corner of the graph.
	Graph partial day: Zooms in on a portion of the logged data.

Graph Manipulation

Table 25 Graphing Functions and Descriptions

Functions	Description
Status Bar	
	Displays the time, date, measured value, and unit of measure at the intersection of the data cursor. Placing the cursor's data on the status bar eliminates the need for X or Y axis labels and provides a larger graph viewing area.
Moving the Data Cursor with the Arrow Keys	
	The data cursor appears as a vertical line in the center of the graph. Move the data cursor to the left or right by using the soft keys or the numeric keypad.
Moving the Data Cursor with the Numeric Keypad	
	The keys 0–9 represent a percentage of full scale. Pressing a numeric key on the keypad while a graph is displayed causes the data cursor to jump to the location on the graph that is represented by that key. For example, pressing the 0 key moves the data cursor to the far left end or 0% position on the graph. Pressing the 5 key moves the data cursor to the middle or 50% position of the graph. Pressing the 9 key moves the cursor to the 90% position.
Next Channel Soft Key	
	Graphs data from the next logged channel. For example, if the sampler is logging Level, Flow, and pH and the Level graph is currently displayed, the **NEXT CHANNEL** soft key causes the Flow channel to be graphed. Pressing Next Channel again will create a graph for pH channel. Pressing **NEXT CHANNEL** again returns to the Level graph, selects a time period of interest, and compares different graphs.

Graphic Display Averaging

The sampler can display a graph that consists of a maximum of 180 individual dots. Since a 24-hour period could contain as many as 1,440 data points (assuming a one-minute recording interval, one reading each minute) it would be impossible to plot every data point on the graph.

When more than three hours (more than 180 minutes worth) of data is graphed, the data points must be averaged. When graphing a partial day of three hours or less, all data points are graphed with no averaging.

When viewing a graph with more than 180 data point, zoom in to the area of interest (using the Graph Partial Day option) before all of the individual data points are displayed.

Sample History

Sample History displays a running history of the sampling program. Displays include sampler number, date and time of each sample, the bottle number it was put in, and the results of the sample cycle. Result messages include:

Message	Results
Success	Sample taken as expected.
No Liquid	No liquid was detected at the liquid sampler.
Key Press	A key was pressed twice during pumping, canceling that sample.

Options Menu Features

1. From the Main Menu, select **OPTIONS**.

11:00 AM 21 - APR - 01	OPTION MENU
TIME / DATE	VOLUME CALIBRATION
ADVANCED OPTIONS	LEVEL ADJUST
READY TO START	

Optional Programs

- Time and Date for internal real-time clock
- Calibrate the sample volume
- Advanced Features
- Adjust level readings of optional integral flow meter

Setting the Time and Date

1. From the Main Menu, select **OPTIONS>TIME/DATE**

11:00 AM 21 - APR - 01		TIME / DATE
ACCEPT		CHANGE AM / PM
	_ _: _ _ AM _ _ -APR- _ _	
CLEAR ENTRY	MODE: 12-HR FORMAT	CHANGE MONTH
USE +/- KEY TO CHANGE 12/24 HR FORMAT		

2. Adjust the real time clock and date setting, using the **CHANGE AM/PM** and **CHANGE MONTH** keys.

Volume Calibration

From the Main Menu, select **OPTIONS> VOLUME CALIBRATION.**

The liquid sensor on the sampler offers unparalleled sample accuracy and repeatability. For most site conditions, no volume calibration is necessary, and the volume collected is accurate within 10% of the requested volume. To improve volume accuracy to 5%, or when sample volume accuracy is adversely affected by unusual site conditions (such as the sample source located higher than the sampler pump), or when the liquid sensor is disabled, then volume calibration should be performed.

Sensor Disabled
When the sensor is disabled, you must calibrate the sample volume(s). If more than one volume is programmed (such as when using storm water or upset sampling), you must calibrate each volume independently (see chart below).

Sensor Enabled

When the sensor is enabled, and volume calibration is selected, a single manual calibration is taken. It does not matter if multiple volumes are programmed (such as when using stormwater or upset sampling). When the sensor is enabled, a single “Manual Calibration” choice provides sufficient information to adjust the sensor to all programmed volumes (Table 26).

Table 26 Sensor Enabled

Liquid Sampler	Available Calibration Volumes
Enabled	Manual Calibration
Disabled	Main Sample Volume
Disabled/Stormwater	Main Sample Volume
	First Flush Volume
Disabled/Upset Sampling	Main Sample Volume
	Upset Sample Volume
Disabled/Storm & Upset	Main Sample Volume
	Upset Sample Volume
	First Flush Volume
Disabled/If Timed Rinse Set	Timed Rinse (in addition to the above)

Calibration Procedure—Sensor Disabled:

Note: *Before calibrating, make certain the desired sample volume in the Setup menu is selected.*

1. From the Main Menu, press **OPTIONS**.
2. Press **VOLUME CALIBRATION**.
3. Select the desired volume to calibrate if more than one is listed (Table 26).
4. Slip the pump tube off the sample fitting (near where it exits the pump housing) and direct the end of the pump tube into a graduated cylinder.
5. Press **START PUMPING**. The pump will purge the line, and start pumping a sample.
6. Press any key when the desired sample volume has been reached in the graduated cylinder. The pump will stop to allow the line to completely drain and then reverse to post-purge the line.
7. If the pumped sample volume is correct, then press **DONE**. If not, repeat the calibration cycle by pressing **TRY AGAIN**.
8. When finished, re-install the pump tube onto the sample fitting.

Note: *To check the sample size after calibration use the Manual Mode function key to take a grab sample. Do not go back into calibration to check the volume since the volume compensation is reset to zero at the start of a calibration.*

If one or more Timed Rinses are selected (sensor disabled), then they must be calibrated as well. The Timed Rinse will rinse the intake line up to 3 times prior to taking a sample.

When calibrating a Timed Rinse, the line is purged, then liquid is pumped toward the sensor. When the liquid reaches the predetermined point, press any key to stop the pump. The pump will reverse and purge the line.

Timed Rinse Calibration Procedure—Sensor Disabled:

1. From the Main Menu press **OPTIONS**.
2. Press **VOLUME CALIBRATION**.
3. Select Timed Calibrate and press **SELECT**.
4. Press **START PUMPING**. Wait while the pump purges the line, it will then start pulling liquid toward the pump.
5. Press any key when the liquid reaches the desired point. The pump then reverses to post-purge the line. Stop the pump when liquid has reached the point past the sensor, but not into the pump body.
6. If the timed rinse stopped where you wanted, press **DONE**. If not, repeat the timed rinse cycle by pressing **TRY AGAIN**.

Calibration Procedure—Sensor Enabled:

Note: *Before calibrating, make certain the desired sample volume in the Setup menu is selected.*

1. From the Main Menu, press **OPTIONS**.
2. Press **VOLUME CALIBRATION.**
3. Main Calibration is the only choice with the sensor enabled. Press **SELECT**.
4. Slip the pump tube off the sample fitting (near where it exits the pump housing) and direct the end of the pump tube into a graduated cylinder.

Note: *To check the sample size after calibration use the Manual Mode function key to take a grab sample. Do not go back into calibration to check the volume since the volume compensation is reset to zero at the start of a calibration.*

5. Press **START PUMPING**. The pump will purge the line, and pump a sample into the graduated cylinder. The pump will then stop to allow the line to completely drain and finally reverse to post-purge the line.
6. If the sample was taken, then press **DONE**. If not, repeat the cycle by pressing **TRY AGAIN**.
7. After pressing **DONE**, a screen will be displayed asking for the Actual Volume. This is the volume measured in the graduated cylinder. Enter this volume and press **ACCEPT**. Note that the requested sample volume is shown on top for reference.
8. When finished, re-install the pump tube onto the sample fitting.

Data Log

From the Main Menu, select **SETUP > ADVANCED OPTIONS > DATALOG.**

The sampler can record up to 116,000 readings from any or all input channels and store them in solid state, battery-backed memory for later viewing or retrieval.

This option allows the selection of channels to log, how often to log, and how to treat the memory when it becomes full (Slate or Wrap).

The sampler has two data logging modes:

- Power Save Mode
- Continuous Mode

Logging Intervals

Logging Intervals are designed to optimize the available memory so that readings can be logged for a longer period of time. A logging interval is the time period over which readings are taken and then averaged.

Power Save Mode
Power Save Mode is automatically initiated upon power-up if a battery is installed on the sampler. When operating in Power Save Mode, the sampler microprocessor spends most of its time asleep conserving battery power. Once per minute, the sampler wakes up, logs the readings from all enabled input channels, performs any other necessary functions and then goes back to sleep.

Selecting a five minute logging interval means that the readings are still taken every minute but the data is not logged until the five minute logging interval is up, at which time the readings are averaged over the previous five minutes and that average is logged

Continuous Mode
Continuous Mode is automatically initiated upon power up if ac power is supplied. The microprocessor stays awake at all times taking readings every second. At the end of the logging interval specified, the readings are averaged over the previous interval and stored in memory. If you select a one-minute logging interval, a reading will be taken approximately every second but no data are logged until the logging interval ends. At that time, the readings are averaged over the logging interval and only the average is logged.

If you select a five-minute logging interval, readings are still taken every second but the data are not logged until the five-minute logging interval ends. At that time, the readings are averaged over the previous five minutes and the average is logged.

Extended Power Mode
Extended Power Mode provides additional battery life by keeping a sampler powered down during the entire logging interval. For example, if a logging interval of five minutes is selected, the sampler stays asleep until the five minutes has expired. It then wakes up, takes a reading, logs it in memory and then goes back to sleep for another five minutes. The sampler does not wake up every minute as it does in normal Power Save Mode.

Selecting a five minute logging interval in Extended Power Mode cause a reading to be taken every five minute and the reading is logged. All channels must share the same logging interval.

Note: *The Review All Items selection from the Setup menu indicates the maximum available logging hours for the channels and recording intervals you selected. The sampler calculates this information when the program is run using the* **RUN/STOP** *key.*

Longer logging intervals result in a longer total recording time. Lower resolution also occurs since more averaging is done at higher logging intervals. You should choose the shortest logging interval possible, while still making data collection convenient. If possible, visit the site once per month to collect data, and then pick a logging interval that almost fills memory over the course of one month.

For example, if the sampler is equipped with the standard complement of RAM memory (128K) and only one channel is logged, then a 2-minute logging interval would take 24 days to completely fill the available memory
If, on the other hand, you chose a 1-minute logging interval, the memory would become full after 12 days.

Table 27 Logging Intervals vs. Total Recording Time for Each Memory Configuration*

Logging Interval	Total Recording Time (days) before memory is full, with 128K Bytes of RAM (standard) (approx. 18,482 readings)	Total Recording Time (days) before memory is full with 512K Bytes of RAM (optional) (approx. 115,630 readings)
1	12.15	80.55
2	24.30	161.10
3	36.45	241.65
5	60.75	402.75
6	72.90	483.30
10	121.50	805.50
12	145.80	966.60
15	182.25	1208.25
20	243.00	1611.00
30	364.50	2416.50
60	729.00	4833.00

* Assuming **one** logged channel.

Dynamic Memory Allocation

The sampler uses a management scheme called “Dynamic Memory Allocation.” All readings are logged in battery-backed Random Access Memory (RAM). RAM memory is allocated to each channel dynamically during operation. If one channel is logging at 5-minute intervals and a second channel logging at 1-minute intervals, the sampler automatically configures memory so that both channels fill memory at the same time. Five times as much memory is assigned to the channel that is logging at 1-minute intervals than the channel that is logging at 5-minute intervals.

Memory can be configured in two ways:

- Slate Memory Mode
- Wrap Memory Mode

Slate Memory Mode
Slate mode causes logging to stop when memory becomes full. The sampler continues to operate but no more data is logged. Use this mode if you don't want to lose any data from the beginning of the logging period.

Wrap Memory Mode
In Wrap mode, when memory becomes full, the oldest reading is discarded each time a new reading is taken. When memory becomes full, the sampler continues to operate and log data. This mode is best used if you are interested in the most recent data readings.

Memory Mode Configuration
To configure the Memory Mode for either Slate mode or Wrap mode:

1. Select **DATA LOG** from the Advanced Options menu.
2. Select **MEMORY MODE** using the **UP** and **DOWN** keys, then press **ACCEPT**.
3. Press **CHANGE CHOICE** to pick either Slate or Wrap, then press **ACCEPT**.

Data Logging Configuration

To configure the sampler for data logging:

Note: *If logging is enabled on any channel, then that channel will have an arrow in front of it to signify that the channel is logged.*

1. Select **DATA LOG** from the Advanced Options menu.
2. Highlight Select Inputs using the **UP** and **DOWN** keys and press **SELECT**.
3. Highlight the channel you wish to log using the **UP** and **DOWN** keys, then press **SELECT** to continue.
4. Press **CHANGE CHOICE** to cycle between Logged and Not Logged, then press **ACCEPT** to continue.
5. Enter a logging interval using the numeric keypad, then press **ACCEPT**. Valid logging intervals are shown on the status bar along the bottom edge of the display for your reference.
6. Select another channel to configure or press **RETURN** to back up one step or press **MAIN MENU** to return to the Main Menu display.

Diagnostics

From the Main Menu, select **OPTIONS> ADVANCED OPTIONS > DIAGNOSTICS.**

In addition to the automatic diagnostics that are performed upon power up, the following manual diagnostics are available:

- Distributor Test
- Event List
- Keypad Test
- LCD Test
- Liquid Sensor
- Velocity Analysis

Distributor Test
The distributor positions the sample tube over the appropriate bottle during multiple bottle sampling. If the distributor arm is obstructed or if a problem exists with the distributor assembly, the arm will not position over the desired bottle correctly.

This test assumes that 24 bottles are installed which is the most difficult to position for the distributor (the most stops and the smallest bottle mouth).

Upon selecting the Distributor Test, the arm returns to the bottle #1 position then moves one bottle at a time for all 24 bottle positions. The arm then reverses direction and again stops at all 24 positions on its way back to the bottle #1 position. Make sure no obstructions interfere with the distributor arm rotation.

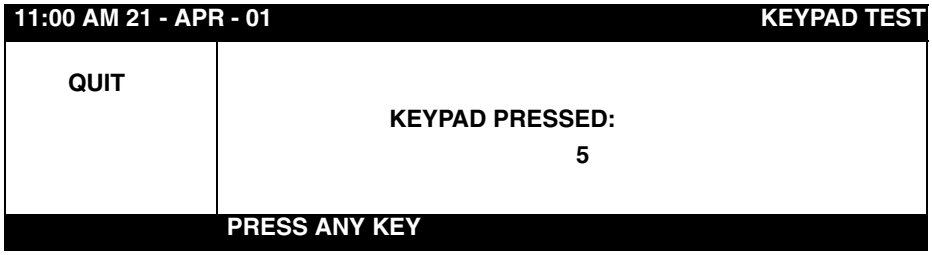
Event List
The Event List diagnostic provides a time/date stamped list of significant events occurring in the sampler. You can review these events to find out when an event occurred and what events preceded or followed the event of interest. Events may be viewed in chronological order from the beginning or end of the event list by selecting View From Start or View From End.

The event list cannot be erase, even when the program is started. Up to 200 events are logged before the list wraps around and the oldest entry is discarded as each new entry is posted.

Logged events include:

- Power On/Off
- Level Adjustments
- Program started, stopped, halted, or resumed.
- Error Messages
- Alarm Activation/De-activation
- Calibration
- Missed Samples (if liquid sensor is enabled)

Keypad Test
Keypad Test provides a simple means of verifying the operation of all front panel keys. Selecting Keypad Test from the diagnostics menu will bring up the following screen:



Pressing any key on the front panel (except for the upper left soft key will cause that key label to appear in the center of the display.

All numeric keypad keys, soft keys, and function keys may be tested in this manner. To end, press **QUIT** (this also verifies the upper left soft key operation).

LCD Test
Display Test allows you to verify that all pixels in the Liquid Crystal Display (LCD) are functional. The LCD is made up of 14,400 pixels that are turned on and off as needed to create the display of graphics and text. Each individual pixel is turned on and off by its own transistor, which means that if a transistor failed, the pixel might not turn on, which could cause an unreadable or confusing display.

Selecting LCD Test from the Diagnostics menu will cause the display to become black for 3 seconds. This allows you to verify that all pixels are functional. A defective pixel will stand out as a white dot in the field of black dots. A message, “The display will remain inverted for 3 seconds” is shown for 2 seconds followed by a 3 second period with all dots turned on.

Liquid Sensor

The liquid sensor contains a high frequency sound transmitter and receiver. High frequency sound waves are sent through the silicone pump tubing by vibrating a piezo-electric crystal. They are picked up on the other side of the tubing by a receiving crystal acting much like a microphone. Since sound waves travel much more efficiently through a liquid than they do through air, the receiving crystal gets a much louder signal when water passes through the tubing in the sensor. The signal from the receiving crystal is converted to a voltage which is proportional to the signal strength. This voltage is used by the sampler microprocessor to sense the exact moment water reaches the sensor. The liquid sensor compares the voltage (signal strength) when the tubing is dry (such as when purging the line) to the voltage when the tubing is full of water (such as when pumping a sample). The dry verses wet voltage reading must be at least 0.8 V dc higher than the 0.3 volts, when liquid is sensed it would be 1.1 volts or higher.

The Liquid Sensor is designated as #1. The diagnostic screen displays the voltage coming from the sensor electronics. Should a problem arise where the liquid sensor is not reliably sensing the liquid, (inaccurate sample volumes, water getting to the bottle during an intake rinse, purge failure), use of the Liquid Sensor diagnostics values will provide valuable information as to the sensor sensitivity.

Velocity Analysis

A velocity probe must be installed in the flow stream and be connected to the meter in order for this diagnostic to work. This diagnostic allows you to view a ‘real time’ reading directly from the Submerged Area Velocity Probe. It will show you the current velocity Signal Strength (percentage of Doppler signal returning to the probe) and a ‘real time’ velocity measurement of the flow stream. Use this diagnostic to determine if you have the probe mounted for optimal velocity measurement. The closer to 100% the Signal Strength is, the more stable the velocity reading will be. If the signal seems low (50% or less), it may be due to improper installation of the probe or a lack of particulate in the flow stream.

Thermal System

The 900MAX All Weather Refrigerated Sampler Thermal Control System is designed to maintain the temperature of water-based samples deposited in containers within the sample compartment at a set point temperature (set point temperature range = 2 to 10 °C) ±1 °C over an ambient temperature range of –40 to +50 °C.

The Thermal Control System is microprocessor controlled, utilizing (sharing) the Sampler Controller microprocessor located on the Sampler Controller CPU board. The microprocessor and associated circuitry are connected via cable to the Thermal Control Interface located in the Power Supply/Thermal Control assembly. Thermal Control Interface circuitry and associated sensors provide temperature data to the microprocessor. Also, Thermal Control Interface circuitry receives control signals from the microprocessor and controls the major thermal components (compressor, fan and heaters).

Temperature of the sample compartment is sensed by the Reference Temperature Sensor. The Reference Temperature Sensor is comprised of an electronic sensing device (thermistor) embedded in a thermal mass. This thermal mass, sized to simulate 150 mL of water, introduces a calculated thermal time constant into the temperature sensing system. Use of a thermal mass results in temperature readings/recordings that are more representative of the actual sample (and not the sample compartment air temperature) and also results in fewer compressor starts (i.e., less mechanical wear on compressor due to starting).

Note: *The refrigerator compressor will not come on when you turn on the power. A timer within the microprocessor is invoked every time the compressor is turned off. Subsequent compressor operations cannot occur until the timer has expired. This timer is also invoked upon initial power up, preventing short cycling due to momentary power failures.*

The microprocessor turns the compressor or evaporator heater on or off based on temperature information gathered by the Reference Temperature Sensor. If ambient temperatures are hot, compressor operation is called for. The compressor is turned on when the sample compartment temperature rises above the defined ON threshold and is turned off when the sample compartment temperature drops below the defined OFF threshold. If ambient temperatures are cold, evaporator heater operation is called for. The evaporator heater is turned on when the sample compartment temperature drops below the defined ON threshold and is turned off when the sample compartment rises above the defined OFF threshold. During periods when the ambient temperature is near the sample compartment set point temperature, both compressor and evaporator heater operation are possible; however, the compressor and evaporator heater are never on at the same time (except during the compressor exercise mode).

The Thermal Control System provides frost free operation. This is accomplished through use of temperature information from the Evaporator Temperature Sensor. Each time the compressor turns on, the system first checks the evaporator temperature. If the evaporator temperature is below freezing (0 °C), it is determined that frost or ice has built up on the evaporator plate. The evaporator heater is turned on and the evaporator temperature is monitored. Once the evaporator temperature rises above freezing, it is determined that no more frost or ice exists and the evaporator heater is turned off. Normal compressor operation follows.

The Thermal Control System controls operation of the compressor heater and optional sampler controller compartment heater. This is accomplished through use of temperature information from the Ambient Temperature Sensor. Ambient temperatures above 10 °C inhibit heater operation. As ambient temperatures drop below 10 °C, these heaters are modulated on and off as a function of ambient temperature using a 5-minute period. At 10 °C, heaters are off (0% duty cycle). At –15 °C, both heaters are on for 2.5 minutes and off for 2.5 minutes (50% duty cycle). At –40 °C, both heaters are on continuously (100% duty cycle).

The Thermal Control System provides two other unique features. The first is the compressor exercise mode. According to the compressor manufacturer, the compressor should be “exercised” or run during periods of non use (e.g.,

cold weather operation). During periods of non use, the compressor is turned on once every 7 days (at midnight) and run for a period of 5 minutes. The second unique feature is short cycle prevention. Again, according to the compressor manufacturer, the compressor should never be short cycled (i.e., started within 5 minutes of its last operation). Short cycling can cause compressor damage.

Thermal System Diagnostics Screen Contents

- Cabinet Temperature (representative of typical sample temperature)
- Evaporator Temperature (temperature of evaporator plate)
- Outside Air Temperature (ambient air temperature)
- Calibration Offset (offset that results from thermal setup calibration)
- Set point (user-defined sample temperature)
- Heater Status (On/Off)
- Compressor Status (On/Off)
- Exercise Timer Status (Time until compressor is exercised)
- Short Cycle Timer (Time until compressor is allowed to start)

Load Program

From the Main Menu, select **OPTIONS> ADVANCED OPTIONS> LOAD PROGRAM.**

The sampler stores up to five sets of program instructions. Each program consists of entries made in the Setup Menu and the Advanced Options Menu.

The sampler is shipped with PROGRAM #1 as the loaded program. To see what program is currently loaded, press **REVIEW ALL ITEMS** in the Setup Menu. All program entries made in the Setup Menu and the Advanced Options Menu pertain to the currently loaded program. To change programs, select the program number (1–5), in the Load Program menu, then make the desired changes in both the Setup Menu and the Advanced Options Menu.

To load a new program

1. Highlight Load Program in the Advanced Options Menu, then press **SELECT**.

2. Enter a number from 1–5 using the numeric keypad, then press **ACCEPT**.

The Site ID is also displayed on the Load Program Menu for your reference. The Site ID can be modified in the Setup menu.

Screen Saver Mode

From the Main Menu, select **SETUP > ADVANCED OPTIONS > SCREEN SAVER MODE.**

The power required to properly light the LCD can consume valuable battery life. Screen Saver Mode is a power saving feature of the sampler.

Battery Power
When the sampler senses that it is operating on battery power, Screen Saver Mode conserves battery life by automatically turning the LCD display off after

3 minutes of keypad inactivity. Pressing any key will turn the LCD display back on. No configuration is required; the meter automatically senses ac or battery operation on power up.

ac Power
When operated under ac power, Screen Saver Mode can be enabled or disabled manually. Enabling the Screen Saver when operating on ac power will prolong the life of the LCD display by minimizing its use.

To change the Screen Saver mode:

1. Highlight **SCREEN SAVER MODE** on the Advanced Options Menu using the **UP** and **DOWN** keys, then press **SELECT**.

2. Press **CHANGE CHOICE** to select a new Screen Saver Mode (Enabled or Disabled). Press **ACCEPT** to save your changes.

Flow Totalizer

The Flow Totalizer consists of three numeric counters that keep track of the total flow being measured. Two software totalizers are standard with a third external mechanical totalizer as an option. The two software totalizers consist of a resettable totalizer and a non-resettable totalizer. Both totalizers are set to zero upon program start.

Scaling multipliers are provided to allow tailoring of the totalizer response to meet the requirements of the application. Some applications with high flow rates will require a high scaling factor, while low flow rates will require a low scaling factor.

The scaling factor is displayed whenever a total flow number is displayed. As indicated in the Status Screen below, the total flow is displayed as “TOTAL (x1000): 465 gal.” Multiplying the displayed total flow by the scaling factor (1000) gives an actual total flow of 465,000 gallons.

11:00 AM 21 - APR - 01	STATUS SCREEN
LEVEL:	8.688 in.
FLOW:	71.39 mgd
TOTAL (X1000):	465 gal
pH:	7.2 pH
BATTERY:	16.9 volts
RUNNING	

1. From the Main Menu, select **OPTIONS> ADVANCED OPTIONS > FLOW TOTALIZER TO DISPLAY THE MODIFY SETUP, RESET, AND VIEW TOTAL SCREEN.**

Modify Setup
Modify Setup selects a totalizer scaling factor and a flow unit of measure.

1. Highlight **MODIFY SETUP** using the **UP** and **DOWN** keys. Press **SELECT.**

2. Set the Totalizer Scaling factor using the **CHANGE CHOICE** key. All three totalizers are scaled with one of seven scaling factors: X1, X10, X100, X1000, X10,000, X100,000 or X1,000,000. The selected scaling factor always applies to all totalizers. Press **CHANGE CHOICE** to cycle through the available scaling choices.

3. Press **ACCEPT** to continue.

4. Set the Total Flow Units using the **CHANGE CHOICE** key to cycle through the choices. Total Flow Units are independent of the flow units selected in the Setup Menu. Flow units of measure include:

   - Acre-feet
   - Liters
   - Gallons
   - Cubic Feet
   - Cubic Meters

5. Press **ACCEPT** to continue.

Reset (Totalizer)
The non-resettable totalizer will only be reset if one of the following conditions occur:

- Change in totalizer scaling
- Change in totalizer units of measure
- Change in primary device
- Start of new program

Note: *The totalizer cannot be reset manually.*

1. Select Reset from the Totalizer menu. A confirmation message will be displayed.

2. Press **YES** to reset the totalizer or press **NO** to not reset the totalizer.

To reset both software totalizers at once, start a program with the **RUN/STOP** key.

Note: *If any type of condition occurs, both the resettable and the non-resettable totalizers are reset. The resettable totalizer can be used to total flow over a finite period and can be reset as often as desired without affecting the other totalizers.*

View Totals

To view the current totals of both the resettable and non-resettable totalizers, press **VIEW TOTALS** from the Totalizer menu. Both totalizer values will appear.

Error Messages

Error Message	Reason
*****Warning!***** Logged data will be lost if you choose to continue? Yes/No.	Making a program change when a program is halted.
• A minimum of 4 points are required. • The entered level value must be greater than the previous value. • No values have been entered in the selectable table.	When entering level-flow or area-level tables, or when attempting to use the tables, a minimum of 4 points must be entered to create a valid table, and level values must increase value as they are entered.
Bottle number must be: 1–xx (where xx = #bottles in the tray).	When selecting a bottle to move to after selecting distributor movement from the manual menu screen.
Bottle quantity must be: 1, 2, 4, 8, 12, 24.	An invalid bottle quantity was entered.
Calibration requires a minimum submersion of six inches.	Level sensor calibration of the bubbler or submerged sensor.
Day must be: 01—xx (where xx is the last day in month).	Invalid number when setting a date.
Distributor movement halted due to key press.	A key was pressed during the distributor test (diagnostics) or distributor movement from the manual menu screen.
Error: Distributor arm is not functioning properly!	The distributor test failed due to an arm obstruction, cable not installed properly, or defect in the distributor assembly.
Function disabled while a pgm is running. Use run/stop key.	Attempted to use manual menu functions or the distributor test while the program is running.
Hours must be: 00—23.	Invalid number entered when setting a time, 24-hour format.
Hours must be: 01—12.	Invalid number entered when setting a time, 12-hour format.
Incorrect password! Access denied.	Incorrect password was entered (password is **9000**).
Interval must be: 000:01–xxx:xx (where xxx:xx is max. interval).	An invalid duration (hrs:min) was entered.
Invalid floating point format, only one decimal point allowed.	A number was entered with two or more decimal points.
Logging intervals must be: 1,2,3,5,6,10,12,15,20,30,60.	An invalid logging interval was entered.
Minutes must be: 00—59.	Invalid number entered when setting a time.
No changes allowed while a pgm is running. Use run/stop key.	An inaccessible selection was made on a menu screen. Stop the program before proceeding.
No retries are possible when the liquid sensor is disabled.	Occurs if Sample Retries is selected from the Modify Selected Items scrolling list, and liquid sensor are disabled. Enable liquid sensor to use retries.
No year entered.	Invalid number entered when setting a date.
pH calibration failed—gain and/or offset out of range. Try again.	The pH calibration calculations yielded an invalid number. Try fresh buffers or a new probe.
Pumping took too long, please try again.	Occurs when the maximum time for timed calibration of a sample volume (or rinse) is exceeded (the maximum is 65000 tens-of-milliseconds, which is roughly equal to 10.5 minutes).
• Sampling halted because of key press. • Sampling halted because the bottle is full. • Sampling halted due to fluid presence after pre-purge. • Sampling halted during rinse—no liquid detected. • Sampling halted due to fluid presence after rinse purge. • Sampling halted—no liquid detected during sample phase.	May occur at the end of a sample attempt. Messages are self explanatory. Investigate the tubing setup from strainer to liquid sensor. Strainer may be plugged or out of water. Tubing may not be installed properly in liquid sensor.
Sensor output voltage too low—cannot calibrate.	The D.O. calibration yielded an invalid result. Try another probe.
Setpoint Sampling and Storm Water cannot both be enabled.	Enabled Setpoint Sampling with Storm Water enabled, or enabled Storm Water with Setpoint Sampling enabled.

Stormwater mode is not allowed when the sampler is configured with one bottle.	Tried to enable Storm Water with a single bottle.
The program cannot start: timed rinse required.	Occurs if the liquid sensor is disabled and timed calibration has not been performed for the rinse cycle.
The program cannot start: the primary device is not properly set up.	If the operator goes partially through the flow meter setup screens but stops before entering all necessary parameters.
The program cannot start: volume calibration required.	If the liquid sensor is disabled and timed calibration has not been performed for the main sample, the first flush or the upset sample volume.
The program setup needs flow to be logged at an interval < or = to the flow time limit.	If an alarm, setpoint or stormwater uses flow rate-of-change as a trip point.
The program setup needs rain to be logged at an interval < or = to the rainfall time limit.	If an alarm, setpoint or stormwater uses rainfall as a trip point.
The signal did not stabilize in time—calibration failed.	When calibrating pH, process temperature, ORP, D.O., D.O. temperature, conductivity, or conductivity temperature, the signal from the probe did not respond within the calibration time limits. Replace buffer solutions (if applicable) or try another probe.
• The time entered is before the first logged value. Data will be display from beginning. • The time entered is after the last logged value. Data will be displayed from the end.	When selecting the time/date for graphing and the selected beginning or ending time falls outside the range of data.
The value must be: xxx—yyy (xxx is minimum, yyy is maximum).	The value entered was out of the legal range, when changing any numeric parameter. The appropriate range is always displayed on the bottom line on the entry screen.
• This program stop is prior to the last program start. • This program start is prior to the last program stop.	When entering start/stop times. Start/stop times must be entered in chronological order.
Timed bottle sets are not allowed unless distribution is bottles-per-sample mode.	Tried to enable Timed Bottle Sets when bottles per sample have not been specified (the bottles-per-sample is used as the bottle set quantity).
Timed bottle sets are not allowed when the sampler is configured with one bottle.	Tried to enable Timed Bottle Sets with a single bottle.
Times cannot be more than 24 hours apart.	When selecting a start and stop time for a graph display the limit (due to screen resolution) is 24 hours.
Too few bottles—review timed bottle sets, upset sampling, & stormwater. Minimum needed:	Occurs if there are not enough bottles to perform all the various functions. Either install more bottles or decrease number if programmed functions.
Too many alarms and setpoints have been requested.	Occurs if more than 20 alarm and setpoint conditions are set. Storm Water start conditions use one or two setpoints.
• Too many samples-per-bottle for the bottle volume. • The sample volume is too large for the bottle volume.	Occurs when the sample volume is checked, if the requested sample volume is too big to fit in the bottle.
Upset sampling is not allowed when the sampler is configured with one bottle.	Tried to enable Upset Sampling with a single bottle.

Trouble Alarm Conditions, Causes, and Solutions

Trouble Condition	Cause	Solution
Low Main Battery	Power supply voltage is less than 11 V dc.	Change batteries.
Memory Battery	Internal memory battery voltage is too low.	Change memory batteries.
Low Slate Memory	Free slate memory is less than 20%. RAM memory is almost full and will stop recording soon.	Download data from unit, halt and restart the program or download data, halt, and change data to wrap mode.
Slate Memory Full	No more slate memory. Unit is in slate memory mode and cannot log any more data.	Download data and restart the program or download data then change the memory mode.
Modem Failure	Unable to initialize modem PCB.	If the modem is enabled, the problem may be found on the modem board and the board may need to be replaced.
Missed Sample	Sample cycle did not result in getting a sample.	—
Purge Failure	Sensor(s) still detecting liquid after a line purge.	—
Jammed Distributor	Distributor arm has jammed on an obstruction.	Remove obstruction.
Unable to Cool	Refrigeration system is unable to reduce temperature in refrigeration compartment to user defined setpoint.	—
Unable to Heat	Heater is unable to increase temperature in refrigeration compartment to user defined setpoint.	—
U-Sonic Echo Loss	The echo has been temporarily deflected by a change in site conditions such as floating debris or foam in the channel, wind, etc.	Check for excessive foam. Remove any debris or build-up.
Xducer Ringing	Transducer is operating within the deadband,	—
U-Sonic Failure	Transducer not plugged in. Cable damaged. Transducer thermal sensor damaged.	Check that the transducer is plugged in and that there is no damage to the sensor.
RS485 Timed Out	Communication error between CPU and remote ultrasonic module.	—
	CPU is not communicating with the Velocity board.	Wait a few minutes to see if it goes away, if it continues it is an indication that there is a problem with the CPU board.
	Not receiving a good velocity reading.	If the logging interval is 1 or 2 minutes and conditions are poor with the problem continuing indefinitely, try increasing the logging interval to allow more time to capture the signal.

Downlook Ultrasonic Sensor Troubleshooting

Problems	Causes	Solutions
RS485 Time Out—Did not get a reading with the specified time allotted.	CPU is having trouble communicating with the Ultrasonic board.	Wait a few minutes and see if the condition goes away. If it continues there amy be a problem in the Ultrasonic, Velocity, or CPU board.
	Difficulty receiving a velocity reading.	Indicates an internal problem.
Loss of Ultrasonic as Level Measuring Device	Blown fuse on CPU board.	Replace fuse. The fuse is located in position F-1 under the gray ribbon cable that connects at position J-1.
	Problem with the ultrasonic board.	Replace if necessary.
U-Sonic Echo Loss—Flow Meter Not Receiving a Return Echo from the Ultrasonic Transducer.	Excessive foam on the water surface causes sound waves to be absorbed rather than reflected.	Check for excessive foam.
	Sensor is nicked, cut, or improperly installed.	Check for nicks, cuts, and check the sensor installation.
	Sensor must be level for proper return of signals.	Make sure the ultrasonic transducer is level.
	Convection currents are present which varies the speed of sound.	Try shielding the transducer from convection currents. Echo loss should not exceed more than two hours.
	Temperature calibration set up incorrectly. Extreme high or low temperature indicates a bad temperature transducer in the temperature sensor.	Go through the temperature calibration procedure and determine what the temperature the unit is sensing. Replace transducer if necessary.
U-Sonic Failure—No Signal from the Ultrasonic Transducer.	Transducer is not connected.	Check the ultrasonic sensor connection on the flow meter.
	Cut or broken cable.	Check for any knick or cuts in the cable.
	Unusual temperature or inability to read new calibrated level.	Re-calibrate the unit.
XDucer Ringing—False Return Echo mask Real Echoes.	Liquid is too close to the transducer.	Try moving the transducer farther from the liquid.
	Obstructions under the transducer.	Check for obstructions on the front and sides of the transducer.
	Coating on the face of the transducer.	Clean the transducer face. If this is a constant problem, try coating the face of the transducer with a very thin film of silicone grease to keep the debris from collecting.
	The transducer resonates against steel mounting rails.	Use the proper rubber isolation washers.
No Change in Level Readings or Inaccurate Level Readings.	—	Check the logged data to see when this started to occur. Go to the event log to see if anything happened during the same time.
	Calibration	Re-calibrate the unit.
	Bad transducer.	Try a different transducer.

pH Troubleshooting

Symptom	Possible Cause	Solution
Meter continuously reads pH 14 or drifts above 14.	Open circuit in either glass or reference electrode.	• Inspect the cable and connector of the faulty electrode for evidence of a crushed or broken cable jacket or brittleness of the cable due to exposure to heat. Discard the electrode if damage is present. • Manipulate meter/electrode connections to check for intermittent continuity. Replace if faulty. • Inspect the bulb, making sure it is filled with solution. If not, shake down (like a clinical thermometer) to displace air in the pH bulb. Retest. • Inspect the bulb for signs of coating.
Temperature is constant or incorrect.	Interface is wired wrong.	Check interface wiring.
	Thermistor is open.	Check interface wiring. Check for open at electrode RTD wire. Disconnect to make measurement. (Should read approximately 100–110 ohms.)
Electrode won't calibrate.	Gain or offset error.	• Ensure that solutions are fresh and labeled properly. • Confirm that electrode and buffer temperatures have stabilized. • Confirm that the wetting cap is removed. • Check bulb for cracks or other damage. • Confirm that interface wires are connected properly. • Check interface connections for corrosion.
Slow response and/or erratic readings.	Very high impedance in either glass or reference electrode.	• Inspect the pH bulb for coating or clogging. If present, clean thoroughly. • Keep the electrode wet at all times. If it dries out, the impedance will increase dramatically. To restore performance, soak in 0.1 N HCl (Cat. No. 1481253) for 30 minutes and rinse well with distilled water. • Chemical degradation of pH glass can occur rapidly in a high temperature or high pH environment, yielding sluggish response. Low temperature environments can double the impedance for every 8 °C drop below 25°C. • A high impedance electrode is extremely sensitive to electrical noise, e.g., oscillating electrical fields generated by motors, generators or discharges from electrical thermostats. A free-hanging cable swinging due to air currents will also generate erratic signals. • Manipulate electrode cable and connections to check for intermittent continuity. Replace as necessary.
	Ground loop problem.	• Check to see if the ground wire is connected properly at the pre-amp junction box. • Check for continuity between the stainless steel lug on the electrode and the ground wire at the interface.
	Temperature is incorrect.	See "Temperature" symptom in this table.
No response to pH change.	Cracked glass bulb.	If the electrode gives readings between 5.8 and 6.2 pH in all solutions, inspect the glass bulb. If damaged, discard.
	Short Circuit.	If a constant reading of 7.0 pH or 0.0 mV is obtained, inspect the cable. If no visible damage exists, remove the connector and test for a short circuit. Replace if faulty.
	High impedance bridge.	Inspect the connector for moisture or corrosion. If wet, rinse well with distilled water and dry thoroughly. Determine the cause of wetness and correct it.

Sigma 900 MAX All Weather Refrigerated Sampler Troubleshooting Issues

Problem	Cause	Solution
Instrument Will Not Power Up With ac Power.	Blown Fuse.	Check the 5 amp fuse located on the back of the controller.
	Circuit breaker issue.	Check the circuit breaker for the main power.
	Breaker is good, but still no power.	Check to see if the outlet is receiving power.
	Breaker and outlet are good, still no power.	Try using a battery or another power supply
Sampler Will Not Create Sufficient Lift.	If any of the holes on the anchor strainer is not submerged the sampler will not create a lift.	Make sure the anchor strainer is completely submerged.
	Intake tubing is nicked or has a small hole.	Replace with new tubing.
	Worn roller assembly and/or pump tubing.	Replace assembly and/or tubing.
Inaccurate Sample Volumes.	The volume was calibrated incorrectly the first time.	Make sure the proper calibration method is used for the site conditions (Auto or Timed calibrate).
	Incorrect intake tube length is programmed in the sampler.	Re-enter the tube length.
	Intake tubing is not completely purging.	Place the tubing at a downward slope from the sampler to the liquid source.
	Anchor stainer is intermittently submerged.	Install the shallow depth anchor strainer, (Cat. No. 2071 or 4652).
	Worn roller assembly and/or pump tubing.	Replace assembly and/or pump tubing.
	When using “Timed Calibrate” (liquid sensor disabled) variable lifts will cause variable sample volumes.	Enable sensor and calibrate volume if site conditions allow.
	Liquid sensor is not functioning properly.	Check the liquid diagnostics screen for valuable information about sensor sensitivity.
	RPM of the motor vary.	Replace motor if necessary.
Submerged Pressure Sensor level readings are inaccurate or no change in level readings.	Improper calibration.	Make sure the unit has been calibrated.
	Desiccant is pink.	Replace the desiccant.
	The sensor was not acclimated to the air temperature before calibrated.	Re-calibrate the sensor making sure the temperature of the sensor is at ambient temperature.
	Water or debris in the atmospheric reference tube.	Clean the area and re-calibrate. To reduce debris collecting on the cable and mounting band, route the cable along the edge of the band and wrap the cable and mounting band with plastic tape. The cable should exit at or near the top of the pipe to keep it out of the flow stream.
	Level is trending downward because of debris at the diaphragm.	Remove the plate and carefully clean the transducer. Re-calibrate the sensor.

Appendix D How to Calculate Pulses/Counts

The sampler is equipped to receive either a momentary dry contact closure or a +5 to +12 V dc pulse from a flow meter, where each pulse represents a known flow increment.

For example, if the flow meter is set to send a flow pulse for every 1,000 gallons of measured flow and the sampler can count 1 to 9,999 flow pulses between sample intervals, you can program the sampler to receive 10 pulses between samples to take one sample for every 10,000 gallons of liquid flow.

To determine the number of flow pulses between sample intervals, you must determine the total number of samples (represented by *n* in the following examples) to be collected, and the period of time over which they are to be collected. You must also know the total flow, *Q*, during the sampling program. The following two-step method should be useful for determining the value for **INTV = _ _ _ _ CNTS** during setup.

1. Determine *f*, where *f* represents the flow increment between samples and n represents the total number of samples to be collected.

   $$f = \frac{Q}{n}$$

2. Multiply the flow increment between samples, *f*, by the pulse frequency output of the flow meter (i.e. 1 pulse per 100 gallons, 1 pulse per 1,000 gallons, etc.). If the pulse frequency output of the flow meter is not known, consult the flow meter manufacturer.

Note: *The final result is not necessarily a whole number. You must round off the result to the nearest whole number.*

Flow-Proportional Sampling Intervals - Using External Pulses
Our samplers are equipped to receive either a momentary dry contact closure or +5 to +12 V dc pulse from a flow meter, where each pulse represents a known flow increment.

Example 1
You want to collect 35 samples over a 24-hour period. The total expected flow over this period is 235,000 gallons. The flow meter pulse frequency is one pulse for every 100 gallons.

1. Determine the flow increment between samples:

   $$f = \frac{Q}{n} = \frac{235{,}000 \text{ gallons}}{35 \text{ samples}} = 6{,}714 \text{ gallons/sample}$$

2. Multiply the flow increment, *f*, by the pulse frequency output of the flow meter.

   $$6{,}714 \text{ gallons/sample} \times \frac{1 \text{ pulse}}{100 \text{ gallons}} = 67.14 \text{ pulse/sample}$$

   Therefore, the value for **INTV = _ _ _ _ CNTS** is 67.
   (67.14 is rounded off to 67.)

Example 2
You want to collect 24 samples over an 8-hour period. The total expected flow over this 8-hour period is 85,000 gallons. The flow meter pulse frequency output is one pulse for every 50 gallons.

1. Determine the flow increment between samples:

$$f = \frac{Q}{n} = \frac{85{,}000 \text{ gallons}}{24 \text{ samples}} = 3{,}542 \text{ gallons/sample}$$

2. Multiply the flow increment, *f*, by the pulse frequency output of the flow meter.

$$3{,}542 \text{ gallons/sample} \times \frac{1 \text{ pulse}}{50 \text{ gallons}} = 70.84 \text{ pulse/sample}$$

Therefore, the value for **INTV = _ _ _ _ CNTS** is 71.

Example 3
You want to collect 48 samples over a 16-hour period. The total expected flow over this period is 1,750,000 gallons. The flow meter pulse frequency output is one pulse for every 1,000 gallons.

1. Determine the flow increment between samples:

$$f = \frac{Q}{n} = \frac{1{,}750{,}000 \text{ gallons}}{48 \text{ samples}} = 36{,}458 \text{ gallons/sample}$$

2. Multiply the flow increment, *f*, by the pulse frequency output of the flow meter.

$$36{,}458 \text{ gallons/sample} \times \frac{1 \text{ pulse}}{1{,}000 \text{ gallons}} = 36.458 \text{ pulses/sample}$$

Therefore, the value for **INTV = _ _ _ _ CNTS** is 36.

Flow Proportional Sampling, External—Using 4–20 mA Signal Converted to Pulses, Flow Signal Interface

The Flow Signal Interface (Cat. No. 2021) is an optional 4–20 mA interface that converts 4–20 mA current signals (from a flow meter) to 12 V dc pulses.

At 20 mA, the interface transmits 10 12-volt pulses per minute. As the current signal decreases, the 12 V pulses decrease proportionally. Typically, users collect a certain number of samples over a given period of time when sampling in proportion to the flow rate.

To calculate the number of 12 V dc output pulses between samples, determine the total number of samples (represented by *n* in the following examples) that you want to collect, and the period of time over which you want to collect them. Use the three-step method presented below to determine the “Total Count” value that you will enter while programming the Setup section of the sampler.

1. Calculate *Q*, where *Q* is the average flow rate (during the sampling program) divided by the maximum flow rate. (The maximum flow rate corresponds to the 20 mA output of the flow meter.)

2. Calculate *t*, where *t* is defined as *a/n*; *n* is the total number of samples collected over a given period of time; and *a* represents time in minutes, over which *n* samples are collected.

3. Multiply *Q* x *t x 10*. Enter the result in the programming step: **INTV = _ _ _ _ CNTS**.

Note: *The product of Q x t x 10 is not necessarily a whole number. You must round off the result to the nearest whole number.*

Use the following examples to help you determine the value that you need to enter when programming for sampling based on counts.

Example 1
You want to collect 24 samples over a 24-hour period on a 4–20 mA flow proportional basis.

Average Flow Rate = 3.5 mgd (average flow rate over the 24-hour period)
Maximum Flow Rate = 10 mgd
a = 1440 minutes

1. Calculate *Q*.

$$Q = \frac{\text{Average Flow Rate}}{\text{Maximum Flow Rate}} = \frac{3.5 \text{ mgd}}{10 \text{ mgd}} = 0.35 \text{ mgd}$$

2. Calculate *t*.

$$t = \frac{a}{n} = \frac{1440 \text{ min}}{24 \text{ samples}} = 60 \text{ min/sample}$$

3. Multiply *Q* x *t x 10*.

$0.35 \text{ mgd} \times 60 \text{ min/sample} \times 10 = 210$
Therefore, the value entered for **INTV = _ _ _ _ CNTS** is 210.

Example 2
You want to collect 48 samples over a 24-hour period on a 4–20 mA flow proportional basis.

Average Flow Rate = 1.75 mgd (average flow rate over the 24-hour period)
Maximum Flow Rate = 3 mgd
a = 1440 minutes

1. Calculate *Q*.

$$Q = \frac{\text{Average Flow Rate}}{\text{Maximum Flow Rate}} = \frac{1.75 \text{ mgd}}{3 \text{ mgd}} = 0.583 \text{ mgd}$$

2. Calculate *t*.

$$t = \frac{a}{n} = \frac{1440 \text{ min}}{48 \text{ samples}} = 30 \text{ min/sample}$$

3. Multiply *Q* x *t x 10*.
$0.583 \text{ mgd} \times 30 \text{ min/sample} \times 10 = 174.9$

Therefore, the value entered for **INTV = _ _ _ _ CNTS** is 175.

Example 3
You want to collect 96 samples over a 24-hour period on a 4–20 mA flow proportional basis.

Average Flow Rate = 0.52 mgd (average flow rate over the 24-hour period)
Maximum Flow Rate = 2 mgd
a = 1440 minutes

1. Calculate *Q*.

$$Q = \frac{\text{Average Flow Rate}}{\text{Maximum Flow Rate}} = \frac{0.52 \text{ mgd}}{2.0 \text{ mgd}} = 0.26 \text{ mgd}$$

2. Calculate *t*.

$$t = \frac{a}{n} = \frac{1440 \text{ min}}{96 \text{ samples}} = 15 \text{ min/sample}$$

3. Multiply *Q* x *t x 10*.

$0.26 \text{ mgd} \times 15 \text{ min/sample} \times 10 = 39$

Therefore, the value entered for **INTV = _ _ _ _ CNTS** is 39.

Example 4

You want to collect 32 samples over an 8-hour period.

Average Flow Rate = 70 gpm (average flow rate over the 8-hour period)
Maximum Flow Rate = 210 gpm
a = 480 minutes

1. Calculate *Q*.

$$Q = \frac{\text{Average Flow Rate}}{\text{Maximum Flow Rate}} = \frac{70 \text{ gpm}}{210 \text{ gpm}} = 0.33 \text{ gpm}$$

2. Calculate *t*.

$$t = \frac{a}{n} = \frac{480 \text{ min}}{32 \text{ samples}} = 15 \text{ min/sample}$$

3. Multiply *Q* x *t x 10*.

$0.33 \text{ mgd} \times 15 \text{ min/sample} \times 10 = 49.5$

Therefore, the value entered for **INTV = _ _ _ _ CNTS** is 50.

Example 5

It is desired to collect 30 samples over a 2-day period.

Average Flow Rate = 0.25 cfs (average flow rate over the 48-hour period)
Maximum Flow Rate = 1 cfs
a = 2,880 minutes

1. Calculate *Q*.

$$Q = \frac{\text{Average Flow Rate}}{\text{Maximum Flow Rate}} = \frac{0.25 \text{ cfs}}{1 \text{ cfs}} = 0.25 \text{ cfs}$$

2. Calculate *t*.

$$t = \frac{a}{n} = \frac{2{,}880 \text{ min}}{30 \text{ samples}} = 96 \text{ min/sample}$$

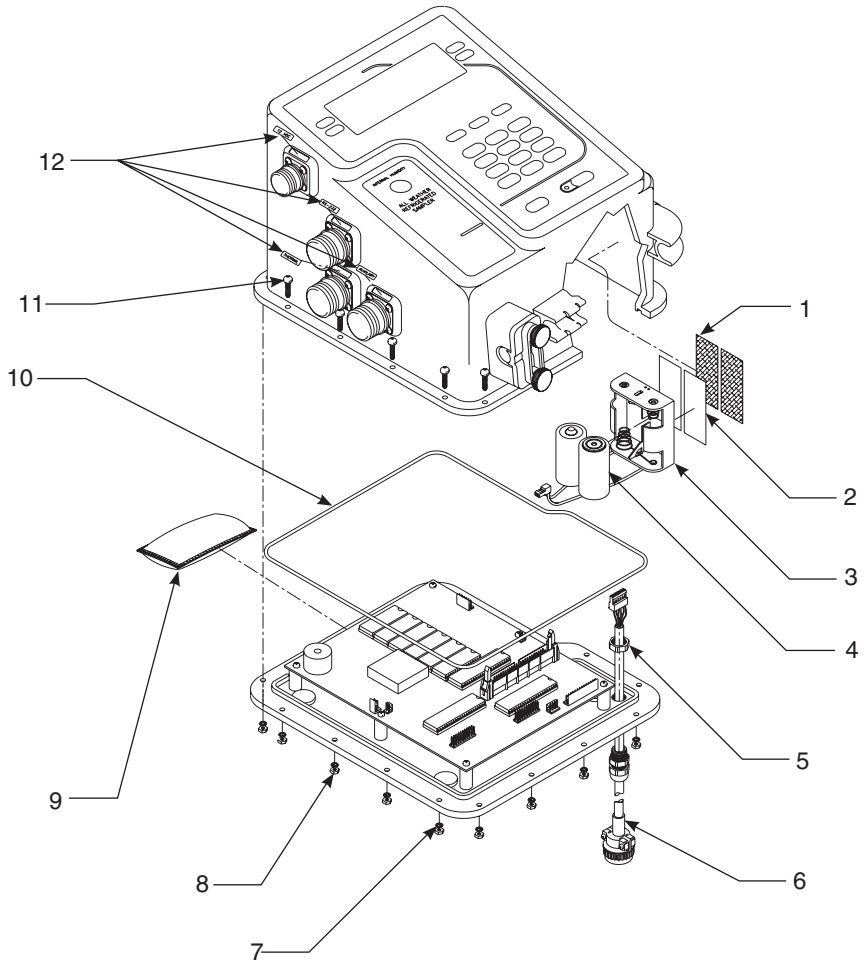
3. Multiply *Q* x *t x 10*.

$0.25 \text{ cfs} \times 96 \text{ min/sample} \times 10 = 240$

Therefore, the value entered for **INTV = _ _ _ _ CNTS** is 240.

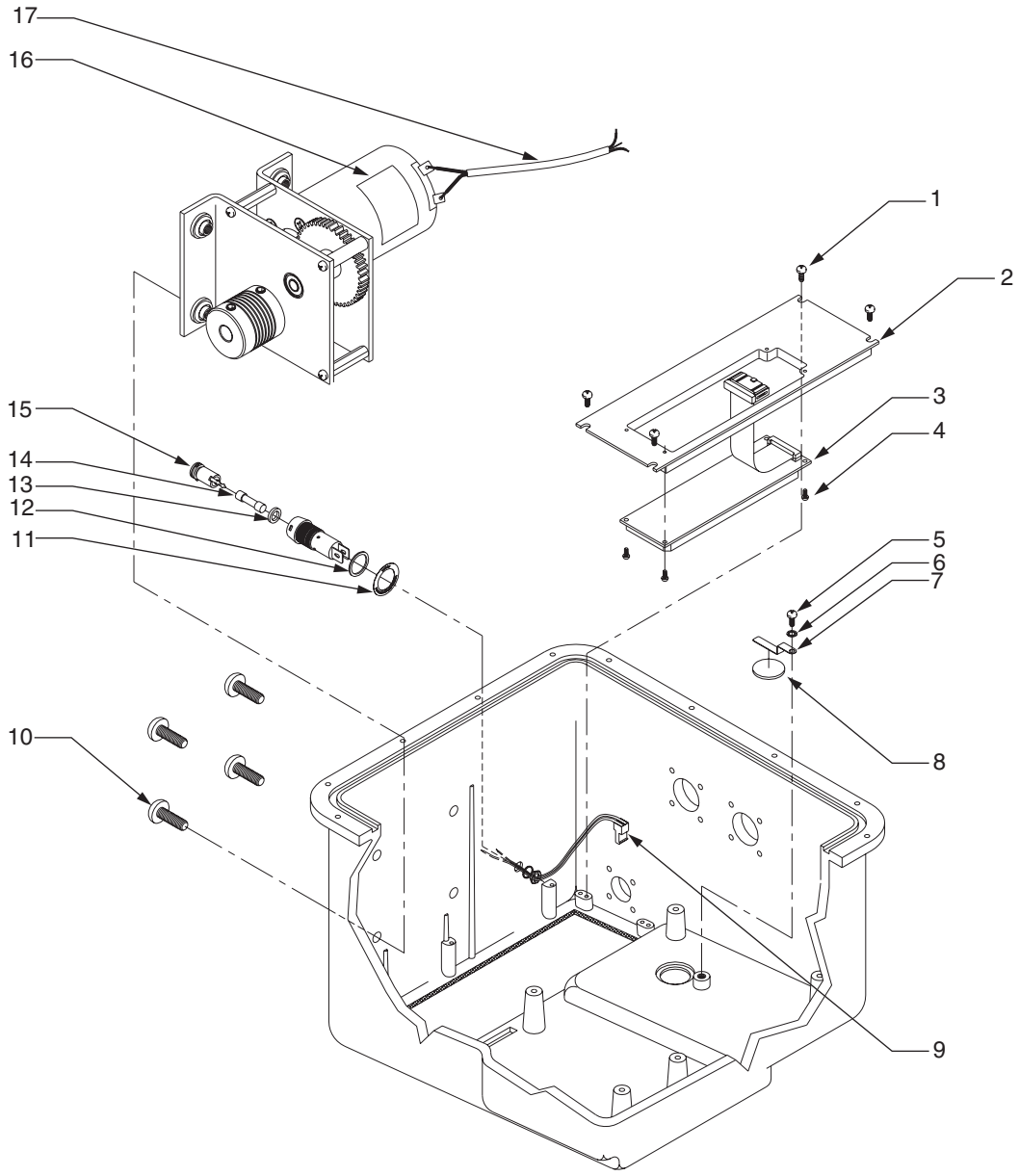
You will notice from the previous five examples that the average and maximum flow rate can be expressed in any units, i.e. mgd, gpm, cfs, etc. However, express the average and maximum flow rate in the **same units** for any given situation.

Sigma 900 MAX AWRS Assembly Drawing (1 of 7)



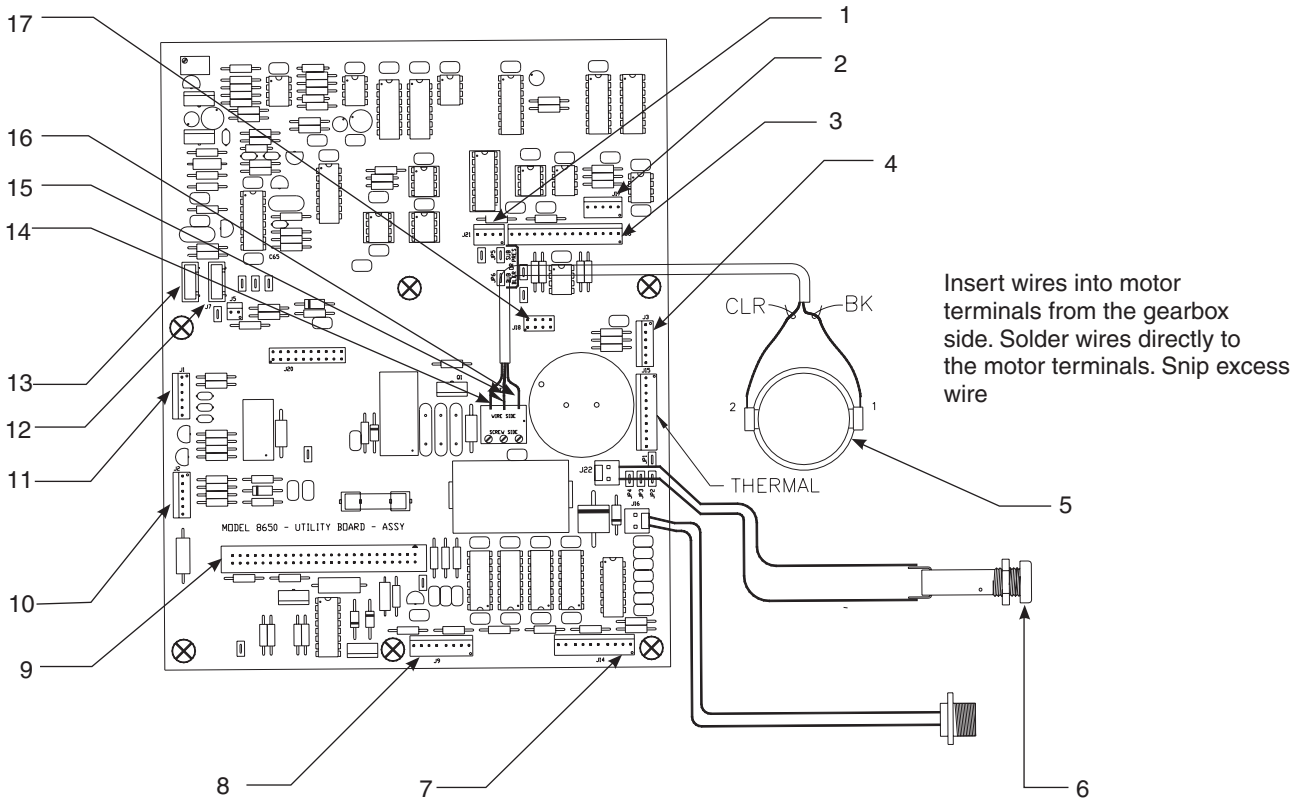
Item	Description	Quantity	Catalog Number
1	Hook & Loop Fastener	2	8791
2	Hook Fastener	1	8792
3	Battery Pack	1	8765
4	C-cell Battery	2	2709
5	Power Supply Cable Assembly	1	8793
6	Distributor Cable Assembly	1	8623
7	Nut	17	SE 301
8	Lock Washer	17	SE 306
9	Desiccant Bag	1	8849
10	O-ring (O-ring Lubricant SE 1048)	1	8606
11	Screw	17	SE 343
12	Overlay	1	8807

Sigma 900 MAX AWRS Assembly Drawing (2 of 7)



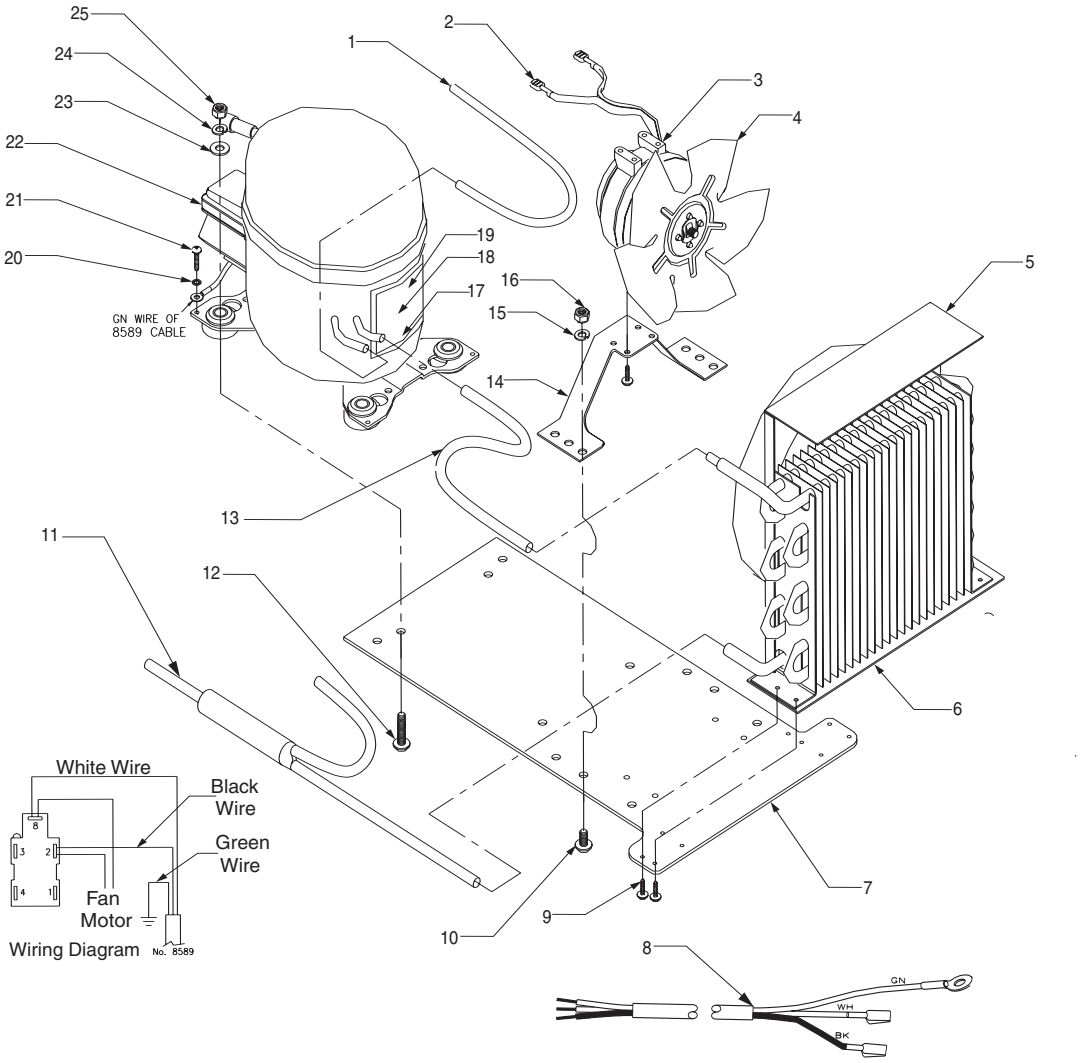
Item	Description	QTY	Cat. No.	Item	Description	QTY	Cat. No.
1	Screw	4	SE 244	10	Screw	4	SE 738
2	Bracket	1	8898	11	Overlay, Fuse Holder	1	1436
3	Display Assembly	1	8911	12	O-ring, 1 x 10 mm	1	3319
4	Screw	4	SE 105	13	O-ring	1	3321
5	Screw	1	SE 214	14	Fuse, 5-A, 250-V, Slow-blow	1	8753
6	Washer	1	SE 208	15	Fuse Holder, 5 x 20 mm	1	3320
7	Bracket, Desiccant Card	1	2594	16	Gear Box Assembly	1	8910
8	Humidity Indicator Card	1	2660	17	Cable Assembly, Motor	1	8859
9	Cable Assembly, Fuse Holder	1	3146				

Sigma 900 MAX AWRS Assembly Drawing (3 of 7)



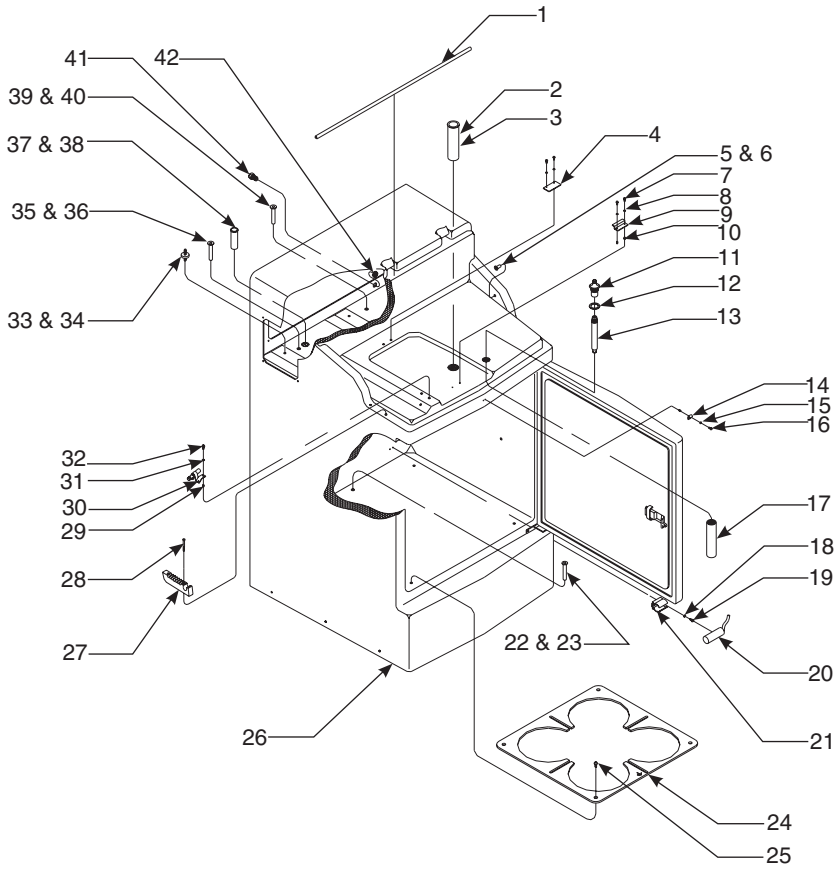
Item	Description
1	Sub Probe
2	Relay Option
3	Bubbler
4	pH/ORP
5	Gearbox Assembly (Cat. No. 8910)
6	Fuse Holder, 5 x 20 mm (Cat. No. 3320)
7	DO and Conductivity
8	Three Channel Data Log
9	CPU
10	AUX
11	Distributor
12	Sensor 2
13	Sensor 1
14	Black TB1–3
15	Shield TB1–2
16	Clear TB1–1
17	4–20 mA

Sigma 900 MAX AWRS Assembly Drawing (4 of 7)



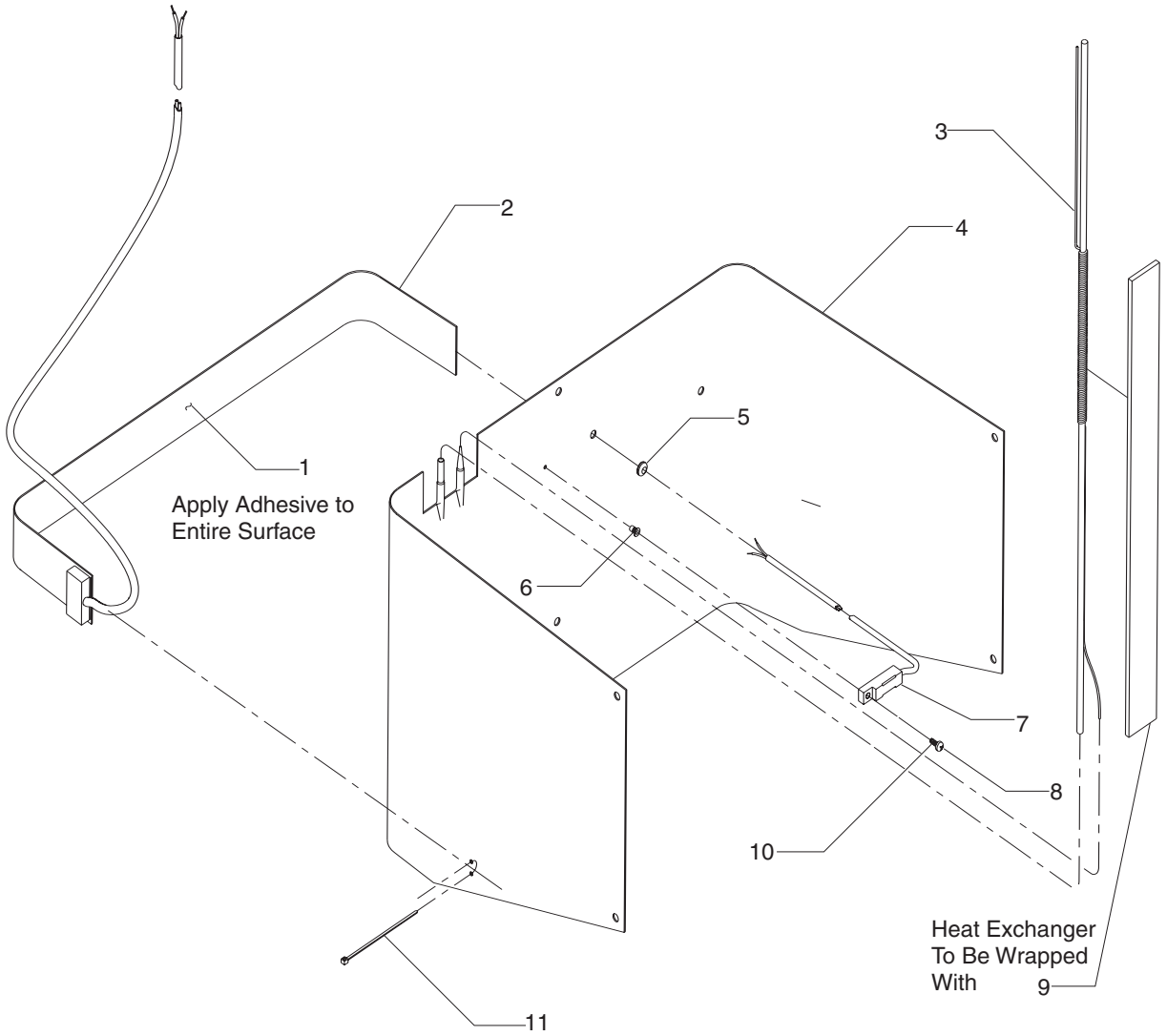
Item	Description	QTY	Cat. No.	Item	Description	QTY	Cat. No.
1	Copper Tube, ¼ OD	1	1965	14	Fan Motor Bracket	1	8692
2	Quick Disconnect Terminal	2	SE 892	15	Lock Washer	4	SE 704
3	Fan Motor	1	8548	16	Hex Nut	4	SE 701
4	Fan Blade	1	8550	17	Primer	1	SE 1051
5	R134A Shroud	1	8554	18	Adhesive	1	SE 893
6	Condenser	1	8553	19	Compressor Heater 100/120 V ac	1	8689
7	Support Plate	1	8556	20	Lock Washer	1	SE 405
8	Compression Fan Cable Assembly	1	8589	21	Screw	1	SE 430
9	Screw	4	SE 430	22	120 V Compressor	1	8546
10	Screw	4	SE 709	23	Flat Washer	4	SE 703
11	Drier Assembly	1	8552	24	Lock Washer	4	SE 704
12	Screw	4	SE 717	25	Hex Nut	4	SE 701
13	Copper Tubing 3/16 OD	1	2864				

Sigma 900 MAX AWRS Sampler Assembly (5 of 7)



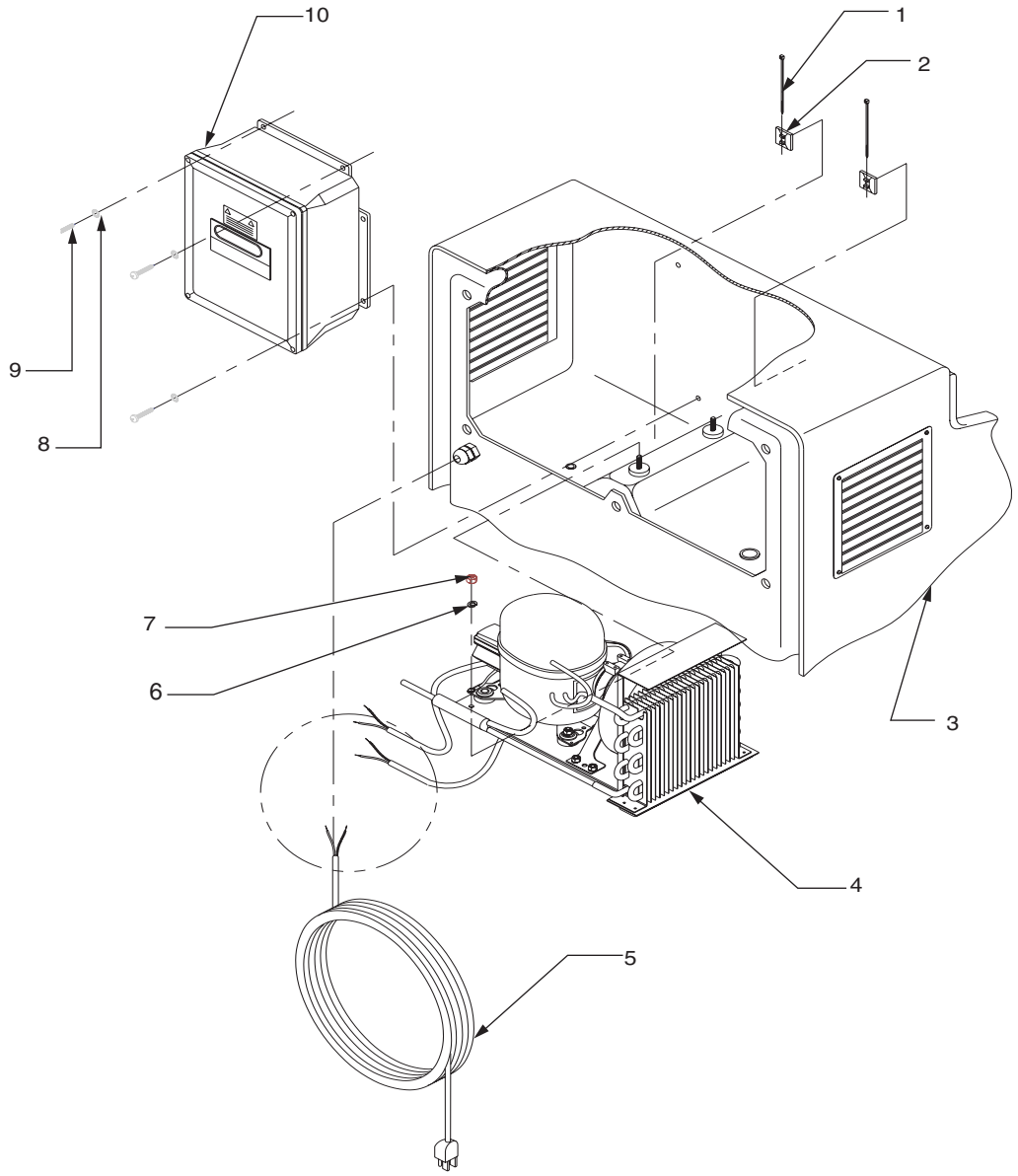
Item	Description	QTY	Cat. No.	Item	Description	QTY	Cat. No.
1	Gasket	1	2962	22	Molded Thru Fitting	1	8936
2	Cable Feed Thru Fitting	1	8734	23	Adhesive	1	SE 1054
3	Adhesive	1	SE 979	24	Bottle Positioner Plate	1	8733
4	Bracket	1	8738	25	Screw	4	SE 702
5	Lid Support Bushing	1	8824	26	Cabinet Assembly	1	8790
6	Adhesive	1	SE 977	27	Wire Tubing Exit Bracket	1	8737
7	Screw	4	SE 408	28	Screw	2	SE 445
8	Lock Washer	4	SE 401	29	Nut Rivet	3	SE 446
9	Bracket	1	8836	30	Strain Relief	1	8889
10	Nut	2	SE 446	31	Lock Washer	3	SE 401
11	Fitting	1	1794	32	Screw	3	SE 416
12	Gasket	1	2885	33	Vibration Mounting	4	8709
13	Fitting	1	2045	34	Adhesive	4	SE 979
14	Lid Latch	1	8896	35	Molded Fitting	1	8936
15	Lock Washer	2	SE 306	36	Adhesive	1	SE 979
16	Screw	2	SE 323	37	Evaporator Feed Thru	1	8750
17	Tubing Feed Thru Fitting	1	8736	38	Adhesive	1	SE 979
18	Lock Washer	2	SE 401	39	Molded Fitting	1	8936
19	Screw	2	SE 408	40	Adhesive	1	SE 1054
20	Sensor Assembly	1	8728	41	Power Supply Cable Assembly	1	8786
21	Bracket	1	8731	42	Nylon Nut	1	8774

Sigma 900 MAX AWRS Assembly Drawing (6 of 7)



Item	Description	QTY	Cat. No.	Item	Description	QTY	Cat. No.
1	Adhesive	1	SE 893	7	Evaporator Temp. Sensor Assembly	1	8726
2	Evaporate Heater, 100/120 V ac	1	8687	8	Screw	1	SE 408
3	Heat Exchange	1	8551	9	Insulator Cork Tape	1	SE 941
4	Evaporator	1	8730	10	Threadlock	1	SE 957
5	Grommet Seal	1	1297	11	Cable Tie	1	SE 817
6	Aluminum Rivet Nut	1	SE 446				

Sigma 900 MAX AWRS Assembly Drawing (7 of 7)



Item	Description	QTY	Cat. No.	Item	Description	QTY	Cat. No.
1	Cable Tie	1	SE 817	6	Washer	4	SE 704
2	Wire-Hold Down	1	7289	7	Nut	4	SE 701
3	Final Cabinet Assembly	1	8700	8	Washer	3	SE 708
4	120 V Refrigerator Assembly	1	3546	9	Screw	3	SE 702
5	Power Supply Cord	1	8853	10	Power Junction Assembly Thermal Control	1	8725

GENERAL INFORMATION

At Hach Company, customer service is an important part of every product we make.

With that in mind, we have compiled the following information for your convenience.

Description	Part Number
3-way Splitter Assembly	939
4–20 mA Interface, 10 ft Cable	2021
900 Series Peristaltic Pump Tubing, 15 ft	4600-15
900 Series Peristaltic Pump Tubing, 50 ft	4600-50
900 Series Peristaltic Pump Tube Insert	8888
All Weather Refrigerated Cabinet, 115 V ac	3548
Anchor Kit	8935
Cascade Sampling for 25-ft Cable	2817
Desiccant Bag (1 pillow)	8849
Distributor Arm, 2-and 4-bottle Sampling	8846
Distributor Arm, 8-bottle Sampling	8845
Distributor Arm, 24-bottle Sampling	8844
Door Assembly	8702
DTU II, 115 V ac	3516
DTU II, 230 V ac	3517
Flow-thru Module	2471
Humidity Indicator	2660
Instrument Manual	8854
Lid Assembly with Latch	8968
Liquid Level Actuator, 25 ft cable	943
Multi-purpose Full Cable, 10 ft	940
Multi-purpose Full Cable, 25 ft	540
Multi-purpose Half Cable, 10 ft	941
Multi-purpose Half Cable, 25 ft	541
O-ring, Main Seal	8606
Pump Tubing, 15 ft, For all distributors and 800 series peristaltic pumps	3866-15
Pump Tubing, 50 ft, For all distributors and 800 series peristaltic pumps	3866-50
Strainer, All 316 Stainless Steel, 6.0 in. long x 0.406 in. OD	2071
Strainer, All 316 Stainless Steel, 7.94 in. long, x 1.0 in. OD	2070
Strainer, Stainless Steel, 3.9 in. long x 0.406 in. OD	4652
Strainer, Teflon®/Stainless Steel, 5.5 in. long x 0.875 in. OD	926
Strainer, Teflon/Stainless Steel, 11.0 in. long x 0.875 in. OD	903
Synchronizing Sampling for 25-ft Cable	2818
Teflon-Lined Connection Kit	2186
Teflon-lined Tubing, 3/8 in., 10 ft	921
Teflon-lined Tubing, 3/8 in., 25 ft	922
Teflon-lined Tubing, 3/8 in., 100 ft	925
Vinyl Intake Tubing, 3/8 in., 25 ft	920
Vinyl Intake Tubing, 3/8 in., 100 ft	923
Vinyl Intake Tubing, 3/8 in., 500 ft	924

Base/Bottle Tray, Composite/Multiple Sampling Accessories

Sampler	Bottle Type	Part Number						
		Bottle	Full Bottle Shut-Off	Tube Support	Extension Tube	Bottle Tray/Positioner	Retainer	Distributor
Composite	2.5 gal. Glass	6559	8847	8838	3527	N/A	N/A	N/A
	3 gal. Poly.	1918	8847	8838	3527	N/A	N/A	N/A
	6 gal. Poly.	6494	8847	8838	N/A	N/A	N/A	N/A
Multiple Bottle	(24) 1 L Poly.	737	N/A	N/A	N/A	1511	1322	8841
	(24) 350 mL Glass	732	N/A	N/A	N/A	1511	1056	8841
	(8) 2.3 L Poly.	657	N/A	N/A	N/A	1511	1322	8842
	(8) 1.9 L Glass	1118	N/A	N/A	N/A	1511	1322	8842
	(4) 3 gal. Poly.	2315	N/A	N/A	N/A	N/A	N/A	8843
	(4) 2.5 gal. Glass	2317	N/A	N/A	N/A	N/A	N/A	8843
	(2) 2.5 gal. Glass	2318	N/A	N/A	N/A	N/A	N/A	8843
	(2) 3 gal. Poly	2316	N/A	N/A	N/A	N/A	N/A	8843

Area x Velocity Measurement Sensors

Option	Description	Part Numbers	
		Connectors	Bare Leads
Standard Submerged Area/Velocity Sensor	Factory Installed Integral Area x Velocity Flow Meter Option ***Note:*** *Factory Installed Integral Depth Only Flow Meter Option is not available with this option.*	4041	4041
	Standard Sensor, Range 0–10 ft (requires cable P/N 3564)	88000	88001
	Standard Sensor, Range 0–30 ft (requires cable P/N 3564)	88002	88003
	Cable, sold by the ft, specify length needed per sensor. Min=10 ft Max=250’	3564	3564
	Junction Box, required for bare lead sensor connection to flow meter.	N/A	4730
	Remote AV, use when the flow meter to sensor distance is greater than 250 ft (requires cable SE 818 and sensor).	5250	5250
	Remote AV Cable, sold by the ft, specify length needed per sensor. Min=10 ft Max=1,000’	SE 818	SE 818
Keppler Submerged Area/Velocity Sensor For cleaner water/few particulates.	Factory Installed Integral Area x Velocity Flow Meter Option ***Note:*** *Factory Installed Integral Depth Only Flow Meter Option is not available with this option.*	4041	4041
	Standard Sensor, Range 0–10 ft (requires cable P/N 3564)	88012	88013
	Standard Sensor, Range 0–30 ft (requires cable P/N 3564)	88014	88015
	Cable, sold by the ft, specify length needed per sensor. Min=10 ft Max=250’	3564	3564
	Junction Box, required for bare lead sensor connection to flow meter.	N/A	4730
	Remote AV, use when the flow meter to sensor distance is greater than 250 ft (requires cable SE 818 and sensor).	5250	5250
	Remote AV Cable, sold by the ft, specify length needed per sensor. Min=10 ft Max=1,000’	SE 818	SE 818

Depth Measurement Sensors

Option	Description	Part Number
Ultrasonic Sensor 40 kHz	Factory Installed Integral Ultrasonic Flow Meter Option	3758
	40 KHz Range 0–10 ft, with 25-ft cable	3028
	Ultrasonic Sensor with Horn, 40 KHz, with 25-ft cable	4008
	Ultrasonic Sensor, CSA Approved for Class I, Division I, Groups A, B, and D Hazardous Locations; with 50-ft cable	4010
	Ultrasonic Sensor, 40 KHz, Range 0–10 ft, with 25-ft cable with bare lead ends.	2653
	Junction Box for ultrasonic sensor conduit installations	3658
Depth Sensor	Factory Installed Depth Only Flow Meter Option ***Note:*** *Factory Installed Integral Area x Velocity Flow Meter Option is not available with Factory Installed Integral Depth Only Flow Meter Option*	8794
	General Purpose Depth Sensor, Range 0–0.576 ft with 25-ft cable	2963
	Range 0–10 ft with 25-ft cable	2343
	Range 0–23 ft with 50-ft cable	2333
Note: *Ultrasonic and depth sensor cables cannot be extended.*		

Sensor Mounting Hardware

Type	Pipe Diameter (Inches)	Part Number	
		Mounting Ring/Band	Mounting Clip
Submerged Area/Velocity Sensor Mounting Rings For 6–24 in. Pipes	6	1361	3263
	8	1362	3263
	10	1363	3263
	12	1364	N/A
	15	1365	N/A
	18	1366	N/A
	20–21	1353	N/A
	24	1370	N/A
Submerged Depth/Velocity Mounting Bands for 15–42 in. Pipes	15	9706100	N/A
	18	9706200	N/A
	21	9706300	N/A
	24	9706400	N/A
	27	9706500	N/A
	30	9706600	N/A
	33	9706700	N/A
	36	9706800	N/A
	42	9706900	N/A
	45	3766	N/A
Submerged Depth Only Sensor Mounting Ring for 6–24 in. Pipes	6	1361	1771
	8	1362	1771
	10	1363	1771
	12	1364	1771
	15	1365	1771
	18	1366	1771
	20–21	1353	1771
	24	1370	1771

Submerged Depth Only Sensor Mounting Band for 15–42 in. Pipes	15	9706100	1771
	18	9706200	1771
	21	9706300	1771
	24	9706400	1771
	27	9706500	1771
	30	9706600	1771
	33	9706700	1771
	36	9706800	1771
	42	9706900	1771

Option	Description	Part Number
Insertion Tool	To remove P/N 1361–1370 mounting rings.	9574

Mounting Plate Hardware for Directly Mounting to Pipe Wall

Option	Pipe Diameter	Part Number
Submerged Depth/Velocity Mounting Plate	All Pipe Sizes	4939
Submerged Depth Only Mounting Plate	All Pipe Sizes	2312

Ultrasonic Sensor Mounting Hardware

Part Description	Part Number
Permanent Wall Mounting Bracket	2974
Adjustable for Floor or Wall	2904
Tripod with Mounting Bracket for Sensor	9538
Cable Straightener	2883
Cable Grip (Requires P/N 2883)	3183

Ordering Information for the U.S.A.

By Telephone:
(800) 635-4567

By Fax:
(970) 461-3915

By Mail:
Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389
U.S.A

Ordering information by E-mail:
orders@hach.com

Information Required

- Hach account number (if available)
- Your name and phone number
- Purchase order number
- Brief description or model number
- Billing address
- Shipping address
- Catalog number
- Quantity

Ordering Information for Outside the U.S.A. and Europe

Hach Company maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send E-mail to intl@hach.com or visit www.hach.com.

Technical Support

Technical and Customer Service Department personnel are eager to answer questions about our products and their use. In the U.S.A., call 1-800-635-1230. Outside the U.S.A. and Europe, send E-mail to intl@hach.com.

Repair Service

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Company Service Center serving your location.

Hach Company
P.O. Box 389
Loveland, Colorado, 80539-0389 U.S.A.

Telephone: 1-800-635-1230 or (970) 669-3050

Fax: (970) 669-2932

Contact Information for Europe

For technical support, repair service, and ordering information please refer to the contact information below for your specific country. For additional information, visit www.hach-lange.com.

Austria
Dr. Bruno Lange Ges. MBH
Industriestraße 12
A - 3200 Obergrafendorf
Tel. +43 (0)27 47 74 12
Fax +43 (0)27 47 42 18
info@hach-lange.at

Belgium
Dr. Lange
Motstraat 54
B-2800 Mechelen
Tel. +32 (0)15 42 35 00
Fax +32 (0)15 41 61 20
info@hach-lange.be

Denmark
Dr. Lange Danmark A/S
Jernhoolmen 34-40
DK-2650 Hvidovre
Tel. +45 (0)36 77 29 11
Fax +45 (0)36 77 49 11
info@hach-lange.dk

France
Hach Lange
Hach SAS
33 Rue du Ballon
F-93165 Noisy Le Grand
Tel. +33 (0)1 48 15 80 80
Fax +33 (0)1 48 15 80 00
info@hach-lange.fr

Germany
Dr. Bruno Lange GmbH
& CO. KG
Willstätterstr. 11
D-40549 Düsseldorf
Tel. +49 (0)2 11 52 88-0
Fax +49 (0)2 11 52 88-143
info@hach-lange.de

Great Britain
Hach Lange LTD
Lennox Road
Basingstoke
Hampshire, RG22 4AP
Tel. +44 (0)12 56 33 34 03
Fax +44 (0)12 56 33 07 24
info@hach-lange.co.uk

Italy
Dr. Bruno Lange s.r.l.
Via Riccione, 14
I-20156 Milano
Tel. +39 02 39 23 14-1
Fax +33 02 39 23 14-39
info@hach-lange.it

Poland
Hach Lange sp.zo.o.
ul. Opolska 143 a
PL-52-013 Wroclaw
Tel. +48 71 3 42 10 -81
Fax +48 71 3 42 10-79
info@hach-lange.pl

The Netherlands
Dr. Lange Nederland B.V.
Laan an Westroijen 2a
NL-4003 AZ Tiel
Tel. +31 (0) 3 44 63 11 30
Fax +31 (0) 3 44 63 11 50
info@hach-lange.nl

Spain/Portugal
Hach Lange S.L.U.
c/ Araba, 45. Apdo. 220
E-20800 Zarauz/Guipùzcoa
Tel. +34 9 43 89 43 79
Fax +34 9 43 13 02 41
info@hach-lange.es

Sweden
Hach Lange AB
Vinthundsvägen 159A
S-128 62 Sköndal
Tel. +46 (0)8 7 98 05 00
Fax +46 (0)8 7 98 05 03
info@hach-lange.se

Switzerland
Dr. Bruno Lange AG
Juchstrasse 1
CH-8604 Hegnau
Tel. +41(0)1 9 45 66 10
Fax +41(0)1 9 45 66 76
info@hach-lange.ch

Hach Company warrants this product to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price, excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- **Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction**
- **Damage caused by misuse, neglect, accident or improper application or installation**
- **Damage caused by any repair or attempted repair not authorized by Hach Company**
- **Any product not used in accordance with the instructions furnished by Hach Company**
- **Freight charges to return merchandise to Hach Company**
- **Freight charges on expedited or express shipment of warranted parts or product**
- **Travel fees associated with on-site warranty repair**

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

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